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IS AN INTERNATIONAL ZOOLOGICAL NOMENCLATURE PRACTICABLE?[1]

By Dr. C. W. STILES

MEMBER OF THE INTERNATIONAL COMMISSION ON ZOOLOGICAL NOMENCLATURE

AFTER an experience of about forty years in an attempt to standardize a code of international rules to govern zoological nomenclature, it will be well for zoologists to consider briefly the outstanding difficulties which at one time or another have inhibited the degree of success which it was hoped would attend the undertaking. Possibly a short review of the subject will indicate whether or not it is worth while to continue the effort.

At the First International Zoological Congress (Paris, 1889) R. Blanchard presented a proposed code of international rules, prepared by himself, after careful consideration of the world's literature on the subject, and naturally he was influenced to no slight degree by the existing French rules. This draft was discussed by the First and Second Congresses (Paris, 1889, and Moscow, 1892) and was formally adopted.

In 1894, the Deutsche Zoologische Gesellschaft adopted an independent code, thereby (at least inferentially) declining adherence to the international code.

In 1895, F. E. Schulze (Berlin, Germany) raised the point at the Third Congress (Leyden), that the Paris-Moscow code was essentially a French production, and he proposed the appointment of an international commission to study all the existing rules with a view to obtaining a really international code.

This proposition produced considerable bitter feeling which threatened to send the Third Congress on the rocks. Oil was poured on the troubled waters,

[1] Presented before the Biological Society of Washington, December 13, 1930.

however, and a commission of five men, representing five different countries (four Old World, one New World), was appointed.

This commission worked hard for three years and attended the Fourth Congress (Cambridge, England, 1898), prepared to present its report. Unfortunately, but not unnaturally, this report was not unanimous in all details, and as a result it was referred back to the commission (which was then enlarged to fifteen members) for further study. In fact, the British administrative office of the congress declined to permit the report to be read, giving as reason the fact that the report was not unanimous.

Thus, Great Britain's administrative representative insisted upon the principle that international rules of nomenclature are not to be made subject to a majority report or a majority vote, but must be based on a unanimous agreement in commission.

Three years later, the commission appeared at the Fifth Congress (Berlin, Germany, 1901) with a more nearly unanimous but not absolutely unanimous report, and was given unambiguously to understand that the congress would not permit its general sessions to be turned into an open forum for the discussion of differences of opinion on rules of nomenclature and that unless the commission could present a *unanimous* report it would not be given a hearing before the general session. Thus the German presiding officer of the congress confirmed the principle insisted upon by the British office. Conferences were held between various members of the commission and various other zoologists. As what promised to be a permanent policy seemed to be formed, and as Germany had been the initiating factor in the appointment of the commission, it seemed logical to attach considerable importance to the reaction of the Deutsche Zoologische Gesellschaft. Accordingly, two foreign (French, American) representatives on the commission conferred with an officer of the Gesellschaft, explained to him some of the difficulties which the commission faced, and asked in how far the commission could rely upon the support of the Gesellschaft in case the commission could, by mutual concessions on various points, iron out some of the differences of opinion, even if the result were not generally popular. The reply was to the effect that the commission could rely absolutely upon the Gesellschaft to support it in the final results. This was confirmed by the three German representatives on the commission.

As one prominent German member of the congress [an officer of the German Zoological Society] stated *in effect:* "It is the duty of the commission to become unanimous in its vote; give us a definite set of rules, good, bad, or indifferent, but be unanimous in your report, and after you give us the rules, see that they are carried out." The words of this prominent German savant were a fair reflection of the feeling we found at the Berlin meeting, so far as the secretary of the commission could discover.[2]

Further concessions were made and finally the commission was permitted to present a brief report to the General Session and the motion prevailed that the congress approve those portions of the report on which the commission was unanimous.

This general incident on *unanimity* is what has been known in the commission as the "Berlin Agreement." It has been accepted as a "gentlemen's agreement" to which the commission has rigidly adhered.

As a corollary to this gentlemen's agreement (requiring unanimous vote in commission preceding the adoption of the rules) follows the parliamentary principle that amendments are subject to the same system or by-laws as the original motion. This principle was definitely incorporated in the by-laws of the commission. Thus, according to parliamentary usage and to the by-laws of the commission, amendments to the original (1901) rules require a unanimous vote in commission.

At the Sixth Congress (Berne, 1904), some slight criticism of the Berlin report developed; this took the form that portions of the report were not entirely clear. These criticisms, emanating from Berlin, did not come to discussion in congress but only in the commission, in which friendly difference of interpretation existed in reference to one article in particular (a point which was made unambiguous at a later Congress). The code was then issued (1905) in French, English and German.

Shortly after the Berne (1904) Congress, there appeared in Germany a new proposition, by a Berlin zoologist, for a total revision of the wording of the code.

It is a recognized fact that courts exist not only for enforcing laws but also for interpreting laws and for settling controversies: "Interest rei publicae ut sit finis litium." The commission has no power to enforce the rules, but at the Seventh (1907) Congress, at Boston, the custom was introduced of issuing commission opinions, in the hope of contributing toward the solution of difficulties and (in case of difference of interpretation) of showing what the commission understood that the rules meant (thus "interpreting" the rules).

Zoologists in the United States, who had been very slow in accepting the international rules and many of whom had for years been working chiefly under the "A. O. U. Rules," now became gradually per-

[2] Report of the International Commission to the Congress, IX^e Congrès int. Zool., Tenu à Monaco, 1913. Published 1914.

suaded that the "Berlin Agreement" was an established factor, that the rules were stable as they stood although they might be built out in various directions to meet new points. As a result, these zoologists rapidly gravitated toward the international rules. In the United States, up to this time, there had been misgivings lest the triennial congresses might adopt, by popular vote, some reactionary rule or policy. But, by 1907, the policy seemed to be generally accepted that a special commission on nomenclature was to guide the subject in the future, and that international unanimity, not local majority, agreement, not dissension, leading, not driving, true international cooperation, not local individualism, friendly discussion, not personal polemic, were to be the determining factors in the future.

In 1910, at the Eighth Congress (Gratz), dissension appeared from Vienna, but it did not make headway.

In 1913, at the Ninth Congress (Monaco), dissension became formulated in two phases in particular, one phase centering in Berlin, the other phase centering in Vienna.

The new secretary of the Deutsche Zoologische Gesellschaft headed a movement which was not in harmony with the assurances the commission had received from his predecessor.

From Vienna came three propositions which were not in harmony with the spirit of the Berlin Agreement on unanimity or with the Berlin, the Berne, and the Boston unanimous reports. The chief proponent of these three changes appeared before the commission to argue his case. In arranging for the hearing, in reply to the question as to how much time he desired to occupy, he said in effect: "If the commission adopts my views I shall not have to speak more than five or ten minutes, *but if the Commission does not adopt my views I shall want to speak six or eight hours or until the Commission does adopt my views.*" The gentleman from Vienna must be given credit for standing by his statement, for seventeen years later (1930), at Padua, his same three propositions were covered by a report[3] he made to the commission and by a very inclusive motion he made in the Section on Nomenclature.

Thus in 1913 the Berlin (1901) policy of conservatism, conciliation, unity and unanimity was threatened by one of radicalism, dictation and dissension. The radicalism centering at Vienna has continued and has gained adherents (*cf.* the Union of German-speaking Entomological Societies). The commission declined, in 1913 and 1927, to desert the Berlin (1901) conservatism for the 1913 radicalism.

Again in 1930, these same three propositions from Vienna were lost in the vote taken by the commission: 1930*A*[4] obtained in commission (out of a possible 18 votes) only 1 vote, 1930*D* only 2, and 1930*F*[5] only 4 votes.

Then came an unexpected action by the Section on Nomenclature, meeting with the commission to hear the commission's report. After the commission had reported that propositions known as 1930*A*[4], *D*, and *F*[5] had failed in commission, a prominent entomologist (Horn) from Berlin came to the support of the defeated Vienna proposition, 1930*F*[5], and introduced a resolution which presented the essential content of 1930*F* as a "definition"[6] instead of as an "amend-

[3] 1930*K*. "The Nomenklaturkommission des Verbandes Deutschsprachlicher Entomologenvereine has recently unanimously voted: 'Die Nomenklaturkommission des Verbandes Deutschsprachlicher Entomologenvereine empfiehlt der Internationalen Nomenklaturkommission, bei dem XI. Internationalen Zoologenkongress die Annahme der von dem British National Committee on Entomological Nomenclature Vorgeschlagenen Revision der Nomenklaturregeln (Proc. Ent. Soc. London, 3, 1928, pp. 2R–13R) mit den von Poche, Ent. Anz. 7, 1927, Nr. 1ff., beantragten Änderungen & einigen weiteren Änderungen in den gegenüber dem ersten Entwurf dieses Committee (1925) gemachten Zusätzen zu befürworten. Sie empfiehlt dem XI. Internat. Zoologenkongress wärmstens, diese Revision mit den gedachten Änderungen anzunehmen.' I personally heartily endorse this resolution."

[4] 1930*A*. "Wenigstens alle jene Anträge auf Abänderungen der, oder Zusätze zu den, Nomenklaturregeln, welche die absolute Majorität des jeweiligen Standes der Nomenklaturkommission und der Stimmen jener Kommissionsmitglieder erhalten haben, die an der Abstimmung über den bezüglichen Antrag teilnehmen, die innerhalb der Kommission am betreffenden Kongress selbst stattfindet, sind dem Plenum des Kongresses zur Beschlussfassung vorzulegen." A referendum on this proposition was conducted among American zoologists in 1927 with the result of 562 U. S. A. (+3 Canadian) votes against it to 4 votes for it. In reporting on this referendum to the 1927 (Budapest) Congress I said:

"(g) American zoologists hold that questions involving the principles and practices of nomenclature should be determined by a relatively small permanent organization, as exists at present in the international commission, and that they do not lend themselves to decision by a triennially temporary, essentially, and very likely, a geographically local majority such as the general meeting of the International Congress.

"(h) Accordingly, the American zoologists withhold their consent to the radical departure from the wise policy which was established at the Cambridge (1898) and Berlin (1901) Congresses and which has been accepted by the succeeding Congresses of 1904, 1907, 1910, and 1913."

[5] 1930*F*. "Veröffentlichungen, in denen der Autor gegen die Grundsätze der binären Nomenklatur verstösst, sind nomenklatorisch nicht zu berücksichtigen. Diese Grundsätze bestehen darin, dass der wissenschaftliche Name der Gattungen aus einem (einfachen oder zusammengesetzten), als lateinisches Substantivum gebrauchten Worte besteht, der der Arten dagegen aus zwei Teilen, nämlich dem Namen der betreffenden Gattung und einem auf diesen folgenden, der gleichfalls aus einem, als lateinisches Wort gebrauchten Worte (oder aus mehreren, einen Begriff bezeichnenden solchen im Sinne des Art. 15) besteht."

[6] Horn's resolution reads: "Der Kongress möge beschliessen, dass nur solche Publikationen als den Grund-

ment." Although the point was made by the secretary of the commission, that the "definition" amounted to an amendment, and that a formula (Suspension of the Rules) had been found and adopted and had been in force for seventeen years under which the difficult cases at issue could be handled under the existing rules, also that Europe and America could not be united on the plan now proposed by the Berlin entomologist, the "definition" was carried by a vote of 22 to 5. The four Americans present voted in the negative.

By all precedent, the resolution adopted by the meeting should have been referred to the commission. In fact this matter was discussed by the president of the Congress with the president and the secretary of the commission and it was understood by the secretary that this method was agreed upon. But instead of following precedent, the resolution was read in General Session, was put to immediate vote and, contrary to the agreement of 1901 and contrary to all precedents in nomenclature from 1898 to date, also out of harmony with the by-laws of the commission (in fact by totally ignoring the vote in commission), the resolution was carried in General Session by the procedure indicated in the proposed amendment 1930*A*[4] which had been defeated in commission by a vote of 14 to 1.

About two years ago, in an address on "The Future of Zoological Nomenclature," I said:

> *Stability of the International Rules.* By all odds, the greatest nomenclatorial question for the future, immediate and remote, is in regard to the stability of the international rules. . . . The immediate future of international rules depends primarily upon coming to a definite international understanding on the generic point as to how much importance is to be attached to the unanimous agreements of the past; and upon this understanding deductions can be based as to how much confidence is justified in majority (namely less than unanimous) agreements in the future. As compared with this fundamental generic point, all specific propositions for amendment to the international rules are secondary and relatively inconsequential.

The answer has been given by the Padua (1930) Congress which in its parliamentary procedure[4] has accepted the leadership of the zoologist from Vienna. While the commission still withheld acceptance to his views, the congress, overriding the report of the commission, voted for the essential content and intent of one of his three propositions[5] by the procedure indicated in a second.[4]

The questions naturally arise as to how the European and especially the German zoologists came to vote in favor of the Horn resolution[6] and how they came to accept parliamentary technique even more radical than that suggested in proposed amendment 1930*A*, especially after the Berlin agreement of 1901, based upon a demand by German zoologists, speaking in their capacity as administrative officers, namely, the president of the Berlin Congress and the secretary of the German zoological society.

In addition to holding in mind the ever-present possibility of a misunderstanding somewhere, the answer to this question is to be found in the fundamental fact that from our American view-point people in continental Europe are not so punctilious in parliamentary procedure as is customary in Great Britain[7] and North America. We do not necessarily have to assume bad faith as explanation for the vote in Padua, but rather an outstanding difference in average parliamentary technique and psychology between continental Europe and North America.

The principle involved, as seen by Americans, is that known as the "continuity of treaties": Two countries, X and Y, conclude a treaty (say in 1830); fifty years later it may happen that the personnel in the governments X and Y has changed 100 per cent., therefore that no individual in these two governments, in 1880, was personally responsible for the treaty which was made in 1830; nevertheless the governmental personnel in both X and Y in 1880 inherited governmental (*i.e.*, organization) responsibility to see that the treaty of 1830 is carried out—even if the individuals in question are personally opposed to the treaty provisions; usually treaties contain a provision that the high contracting parties may recede from the treaty after one year's formal notice that they intend to recede; but until that year is up the treaty is binding on the two governments, and any infraction against the terms of the treaty constitutes a violation of the treaty and according to its seriousness may be a *causa belli;* further, when one of the countries breaks the treaty the other country is thereby released from its provisions.

In the strict interpretation of the word, the international rules do not constitute a "treaty," for they have not been formally confirmed by the respective governments; but the fact remains that they were adopted by an international congress which assembled in Berlin at the invitation of the German government and that official delegates from the various governments, societies, museums, universities, etc., were in-

sätzen der binären Nomenklatur entsprechend angesehen werden sollen, in denen der Gebrauch von einem einzigen Wort als Gattungsname und von einem einzigen Wort als Speziesname konsequent durchgeführt ist. Zusammengehörige Wörter wie *cedo-nulli* und *noli me tangere* gelten als ein Wort.''

[7] Yet four zoologists representing Great Britain voted with the majority, a fact best explained by assuming a misunderstanding somewhere.

volved in the vote. They constitute, therefore, a quasi-treaty between scientific organizations or as older members of the commission have frequently termed it "a gentlemen's agreement." This is probably the nearest approach to an actual "treaty" which is possible in the matter of nomenclature.

Only two of the fifteen commissioners of 1901 are still members of the commission, and the two leaders (from Berlin and Vienna) back of the Horn resolution are not and never have been members of the commission. From the American point of view the responsibility for the unanimous report demanded by officers of the British (1898) and the German (1901) congresses and accepted by the commission is an organization responsibility; any member of the congress or the commission is at liberty of course to hold any view he wishes, but as a member of the organization he inherits the responsibility adopted by the organization in 1898 and 1901 and any deviation from the agreement of 1901 (later written into the by-laws of the commission) constitutes a breaking of that agreement regardless of the fact that the men voting for the break act in absolutely good faith.

The by-laws of the international congress itself are not very detailed. In 1927 a subcommittee of two members of the Permanent Committee was appointed to redraft the by-laws of the congress. This redraft was presented to the Permanent Committee at Padua in 1930 and will be submitted eventually to the prominent zoological societies of the world for consideration. This manuscript contains provisions which, if enforced, would absolutely prevent the action taken by the Padua Congress on the Horn resolution. In the absence of a set of by-laws for the congress (as distinguished from the commission) excluding the Padua vote on the Horn resolution, opinion will be divided as to the validity of the Padua vote.

Many Europeans will maintain that the congress was free to adopt any resolution proposed.

Zoologists in the United States will almost if not entirely unanimously contend that the action was (*a*) invalid from a parliamentary standpoint, (*b*) contrary to all precedents in nomenclature from 1898 to 1930, (*c*) contrary to the spirit and effect of the 1901 Berlin agreement, (*d*) contrary to the words of the same except that the Horn resolution was presented as a "definition" while in effect it amends, (*e*) contrary to the by-laws of the commission, (*f*) contrary to the Padua 1930 vote 14 to 1 in the Commission on Nomenclature against Proposition 1930*A*, (*g*) even more radical than Proposition 1930*A* which has been consistently opposed by American zoologists, (*h*) that it makes procedure in nomenclature subject to a chance majority vote (on any motion suddenly introduced from the floor, without international notice) determined by the geographical locality of the meeting of the congress, and (*i*) makes the rules of nomenclature subject to sudden and recurrent (three to five year) changes, thus making them unstable and without reasonable protection to the views of the minority present or to the views of countries and specialties not represented or poorly represented at the congress.

For thirty-five years I have favored and worked for internationalism in nomenclature. It is now difficult for me to deny that I am disillusioned in view of the Padua vote. The question arises in my mind whether it is really worth while to spend further time discussing and rediscussing the same old problems and to make agreements in good faith only to learn later that some of our colleagues because of other premises and parliamentary technique different from that which we follow feel at liberty to disregard these early engagements of their predecessors because they themselves were not members of the commission when the agreement was actually made or for other reasons, and to whom a *res judicata* means so much less than it does to us.

If there has been any misunderstanding on either side, it is time this should be cleared up.

I unreservedly maintain that the Padua vote on the Horn resolution was unparliamentary and invalid, but I have grave doubts whether this point of view will be accepted by certain of my friends and colleagues in central Europe.

From the point of view based on the principle of the continuity of treaties and its application to a gentlemen's agreement I find it difficult to escape the conclusion that the action of the 1930 Padua Congress automatically releases (in fact divorces) from further cooperation with the International Congress or the International Commission on Nomenclature all zoologists who gave their adherence to these rules on basis of the Berlin, 1901, Agreement, or on basis of the by-laws of the commission, and who count permanency and stability of rules as one of the essentials in nomenclature.

American zoologists face the problem of defining their position as to the immediate future of nomenclature. It is not a question of the Americans deciding to revolt. The revolt has already taken place on the part of the Europeans under the leadership of Berlin following a seventeen-year preparatory propaganda from Vienna. The question before the Americans is whether they will submit to a modification of the principle on basis of which American zoologists allied themselves to the international rules (all other points are secondary in comparison), or whether they take the position that it is better policy for American and European zoologists to wish each other good luck and for each of these two groups to settle its own problems in nomenclature by its own methods.

The point is striking that so many divergent and different propositions emanate from Berlin. The question lies near as to how united the Germans really are on the principles and practices of nomenclature and how definitely they understand just what they want and how permanently they are disposed to carry out *majority* agreements in view of the fact that the history of nomenclature since 1910 has demonstrated that they no longer emphasize the importance to be attached to *unanimous* agreements. Frankfurt a.M. seems to be at least one center which has a united policy.

If, instead of arguing on the premise of the principle of continuity of treaties, one wishes to adopt the view that a member of the congress or of the commission, in 1930, who was not personally a party to the 1901 agreement is at liberty to disregard the existence of that agreement, certain conclusions seem to follow logically, *i.e.*, (*a*) only the two surviving members of the 1901 commission bear any obligation to the 1901 agreement, (*b*) only those persons who voted in the affirmative on the Horn resolution bear any obligation to that resolution, (*c*) the international rules are, always have been, and always will be a scrap of paper, and (*d*) American zoologists should now determine whether they will accept this new interpretation and try to adhere to rules which Europe will nearly always[8] be in a position to modify at will by a local geographical majority voting on a motion made from the floor in the Section on Nomenclature with right of vote by any person who has qualified by payment of the five dollar membership fee.

Whichever premise is followed, it is obvious that American zoologists should make their position unambiguous, for "silence gives consent."

To follow the early example of the A. O. U. in the hope of making more rapid and more lasting progress does not mean that the work of the past forty years will be thrown away because of nomenclatorial divorce. The subject of the theory and practice of nomenclature is more generally understood now than formerly and eight or nine sets of rules (national or international, general or special) will have been reduced essentially to two sets which differ from each other only in a few important features. Further the feasibility of a continuing international unity is not obvious under existing different view-points as to the importance to be attached to agreements, to methods of parliamentary procedure and to a *res judicata*.

The technical nomenclatorial question 1930*F* at issue in the 1930 Congress is trivial in comparison with the revolutionary and radical principle involved in 1930*A*[4, 6] (of which it became a test case). 1930*A* (accepted in an even more radical form by the congress) makes the rules subject to change every few years by a chance majority vote in the Section on Nomenclature (even in opposition to the vote in the Commission on Nomenclature) and the General Session, determined by the geographical center in which the congress meets and not safeguarded by the conservatism of a permanent commission. To this the American zoologists will never consent if I interpret correctly their votes of 1927 and 1930 which have reached my office. If the action of the 1930 Congress stands (and I see no chance to revise it for five years to come) a nomenclatorial split between Europe and the United States seems inevitable—in fact it has already been brought about by the Padua vote.

1930*F*, Binary *vs.* Binomial: The question of binary *vs.* binomial, the point on which the Padua Congress voted, has a long and somewhat tedious history which need not be reviewed here.

The issue as based on 1930*A*[4, 6] is clear cut and need not be complicated at present by discussion of other points. Suffice it to say that the commission has passed upon the principles of 1930*F*[5] by unanimous vote, that it later (in Opinion 20) clearly illustrated the meaning of its vote, and that propositions to revise the vote have failed in the commission on no less than four occasions.

Conclusion: I recommend that a meeting of American zoologists interested in nomenclature be called at an early date. If a preliminary meeting be held in Washington, D. C., many members of committees on nomenclature are immediately available. This will include not only members of Washington committees but also some of the members of practically every American national committee on zoological nomenclature. This joint committee can canvass the entire situation and make recommendations to the Washington societies which they represent, and members of national committees who are present can report to their national committees as to the action taken by the Washington joint meeting. The national committees can then report to their societies with recommendations.

The foregoing plan can crystallize American opinion very rapidly.

I pledge myself to abide by the decision of the American zoological profession thus represented as to whether I remain with or resign from the international commission—regardless of my own personal views. But if Americans accept the Padua vote, I shall feel it necessary to resign at least as Secretary to the Commission on the ground that some person in harmony with the major and fundamental policies of the commission should shoulder the responsibilities necessarily connected with the very unenviable and unpopular position as its *Capra hircus*.

[8] Of the eleven congresses thus far held, ten have met in Europe, one in the United States.

OBITUARY

GEORGE PETER DREYER

George P. Dreyer was born in Baltimore, September 22, 1866, and until 1900 his life was spent in that city. He was educated in Baltimore City College and in the Johns Hopkins University. Following his A.B. degree from Hopkins in 1887, he was fellow in physiology during '88 and '89 under the distinguished physiologist, Newell Martin, and received his Ph.D. degree in 1890.

Dr. Dreyer's early intention was to study medicine, but his contacts at Hopkins with Martin, and later with Howell, definitely brought him to decide on physiology as a career; a decision which he never regretted. He valued highly the acquaintances made in those earlier days. Such men as Henry Sewall, E. G. Conklin, T. H. Morgan, A. C. Abbott, C. W. Greene, Percy Dawson, Joseph Erlanger and David Lingle left pleasant and lasting memories.

From 1890 until 1900 he was associate professor at his Alma Mater, and during this time he became the master of physiological technique and manipulation for which he was justly famous. No one ever saw Professor Dreyer operate without admiring his skill. As a teacher he was as successful as he was technically skillful. His demonstrations were uniformly successful, and accomplished with a facility which often hid the actual difficulties. His first humiliation occurred when he had to use spectacles to catheterize Wharton's duct. While he accepted this premonition of approaching age philosophically, he frequently spoke of it.

In 1900 Dr. Dreyer came to Chicago as professor of physiology and physiological chemistry in the College of Physicians and Surgeons, which had formed an affiliation with the University of Illinois. The conditions were far from ideal and far from what he had anticipated. The affiliation proved to be loose and was soon broken, and for a time, the College of Physicians resumed its proprietary status. During the interim Dr. Dreyer remained, hoping for a reunion which would bring university standards, conditions and ideals. Satisfactory conditions, however, were not established until about 1915, and to make these conditions operative Dr. Dreyer assumed the office of dean. In this office he developed university working conditions and ideals for others, but at the cost of his health and with the sacrifice of research for many years. While acting as dean, he suffered an attack of pneumonia, followed by empyema, which left him physically incapacitated for more than a year. While he was afterwards mentally alert and able to resume professional duties, he had not the physical stamina demanded for research. Until the time of his death on February 27, he was compelled to avoid unnecessary exertion and to adopt measures to retain and to promote health.

As a health-promoting measure, as well as from actual pleasure, he spent much of his leisure time in gardening, and the flower garden of his suburban home was the rendezvous of amateurs and friends.

Dr. Dreyer was a pioneer physiologist in Chicago; when he came many men on the Atlantic seaboard could visualize only vulgarity and incivility west of the Alleghenies. So far as physiology was concerned this was "pragmatically" true. Only Jacques Loeb, at Chicago, and Winfield Scott Hall, at Northwestern, had preceded him. A. P. Mathews, David J. Lingle, George Neil Stewart, C. C. Guthrie and Alexis Carrel soon followed. All these men bore the burden and worked in the heat of the day, but none of them were exposed to the disruptive ultra-violet rays as was Dreyer. An ancient prophet said that old men dream dreams, and the young men see visions. Dreyer was young and had vision, and Chicago to-day is physiologically what he hoped it would be. His only regret was that he was unable to contribute more to his chosen profession. His best known research was the discovery of secretory nerves to the adrenal glands, and his work on blood proteins and differential respiration. In 1899, by using large quantities of the adrenal venous blood, he was able to give the first convincing proof that the blood pressure raising principle is actually secreted into the blood flowing from the gland. His findings were afterwards fully confirmed by other workers. More important than his discoveries were his generous aid to others, and the preparation of the field for others to reap where he sowed.

Within the past two years, he devoted much time to planning a new laboratory in which he hoped to again resume research work. He lived to see this laboratory almost ready for occupancy, but after thirty years in the wilderness of promise he was allowed to see but not to enter, the promised land.

During his thirty years' service to the University of Illinois, Professor Dreyer came in contact with thousands of students and graduates. He was known to them as a great teacher, a profound student, a gentleman and a friend.

H. A. McGuigan

University of Illinois,
College of Medicine,
Chicago

RECENT DEATHS

Dr. L. H. Pammel, professor of botany since 1889 at the Iowa State College, died on March 23, while returning from a winter in California. Dr. Pammel was in his sixty-ninth year.

DR. JOHN EDGAR TEEPLE, consulting chemist, known for his work in the development of the potash industry in the United States, died on March 23, at the age of fifty-seven years.

EDWARD DWIGHT PRIEST, designing engineer in the railway department of the General Electric Company, with which he was connected for thirty-four years before his retirement in 1926, died on March 26.

SCIENTIFIC EVENTS

AUSTRALIAN VITAL STATISTICS

THE Sydney correspondent of the *Journal* of the American Medical Association reports that at the end of 1929 the population of Australia reached the total of 6,414,372. The rate of growth during 1929 was 1.22 per cent. and for the ten years 1.92 per cent., which is probably the highest rate of increase in the world. Excess of births over deaths contributed 70.5 per cent. of the total increase, and net immigration 29.5 per cent. The density of population of Australia is only 2.16 persons per square mile, and varies from one person per hundred square miles in the Northern Territory to 20.22 persons per square mile in Victoria.

The birth rate for 1929, 20.31 per thousand of population, was the lowest ever recorded. Compared with many other countries the Australian rate is low, but it is fortunately accompanied by a low death rate, giving a rate of natural increase that is equaled in few countries. Extranuptial births numbered 4.70 per cent. of all births registered. The proportion of multiple births is one case of twins in every 98 confinements and one of triplets in 14,242 confinements. The average number of children per mother was 2.96, against 2.99 in 1928.

During the year, 60,857 deaths were registered, corresponding to a rate of 9.55 per thousand of the population. This rate was slightly above the average of the previous five years, but nevertheless compares most favorably with other countries. The principal causes of death were: heart diseases, 15.3 per cent.; cancer, 10.3 per cent.; violence, 6.0 per cent.; cerebral hemorrhage, 5.8 per cent.; tuberculosis, 5.7 per cent.; nephritis, 5.6 per cent.; pneumonia, 4.9 per cent. The number of deaths in childbirth was 5.1 per thousand children born. The infant mortality rate for Australia (deaths of children under the age of 12 months) per thousand children born was 51. This rate is the lowest ever recorded in Australia and is, with the exception of New Zealand, the lowest in the world. The rate for New Zealand is 34.

THE PACARAIMA-VENEZUELA EXPEDITION

MEMBERS of the American Museum of Natural History, the American Geographical Society and the New York Botanical Garden are organizing an expedition to the unexplored uplands of southern Venezuela. The plans for this undertaking, which is scheduled to begin the middle of August, provide for a comprehensive scientific survey of the region. In order to facilitate the administrative and executive details of organization a membership corporation has been formed under the title "The Pacaraima-Venezuela Expedition Inc." At the first meeting of the board of directors Mr. H. E. Anthony, curator of the department of mammalogy of the American Museum of Natural History, was elected president of the corporation; Dr. H. A. Gleason, curator of the New York Botanical Garden, vice-president; R. R. Platt, head of the department of Hispanic-American research of the American Geographical Society, secretary, and Fred H. Smith, bursar of the museum, treasurer. The expedition will be led by staff members from the three institutions above mentioned. Those taking part are: Leader, Mr. H. E. Anthony; assistant leader, Mr. G. H. H. Tate, geologist, who has been on seven expeditions to South America for the American Museum; C. C. Graves, formerly of the Field Museum of Natural History expedition to Alaska and the Arctic, geologist; W. B. Miller, Jr., who has traveled in southwest United States, west and southwest Venezuela and northern Rhodesia, topographer and geologist; C. B. Hitchcock, who has already been to Venezuela, botanist; A. C. Smith, acquainted with Peru and Brazil, chief pilot and topographer; G. A. Thorn, aerial photographer and pilot; A. C. McKinley, an assistant aeroplane mechanic, and C. Broten, the three last mentioned having been members of the Byrd Expedition.

The region of exploration consists of about 40,000 square miles at the headwaters of the Orinoco River between Mt. Roraima, a sandstone table-mountain at the junction of Venezuela, British Guiana and Brazil, and Cerro Diuda, a mountain similar to Mt. Roraima, about 400 miles south, on the upper Orinoco. The expedition plans to map this region by means of aerial photography; to outline its physiography and geology; to make collections of its animal and plant life and to study the Indian tribes.

The plan of the expedition has been presented to General Gomez, President of Venezuela, who is in complete sympathy and has assured the leaders of his full cooperation.

SHENANDOAH PARK HIGHWAY

ONE of the most scenic highways of the country, that may ultimately extend for 150 miles, is to be built

along the summit of the Blue Ridge Mountains throughout the length of the Shenandoah National Park area in Virginia. Plans for the construction of this spectacular skyline drive are now being completed by the National Park Service in cooperation with the United States Bureau of Public Roads.

In this connection, decision was reached to limit main-road construction in the park area to this particular project. Already there are roads just outside the proposed park boundary and completely surrounding it, and in addition two lateral roads cross the area. These are the Lee Highway between Sperryville and Luray and the Spottswood Trail connecting Standardsville and Elkton. The tentative plan to construct another lateral road either by way of the Rapidan or the Robertson River Valleys to meet the ridge road has therefore been abandoned.

These final plans are based upon the recommendations of Chief Architect Thomas C. Vint and Assistant Landscape Architect Charles E. Peterson, of the National Park Service, and followed a thorough investigation by them of local conditions. Preliminary surveys have already been made by the Bureau of Public Roads.

While the proposed highway eventually will follow the skyline of the ridge from Front Royal to Rock Fish Gap, between Afton and Waynesboro, the first unit to be taken up for construction is that portion, 50 miles long, between Panorama (Thornton Gap) and Swift Run Gap. At the latter point the road will connect with the Spottswood Trail.

The highway system as proposed under this general development plan will cover the park area more thoroughly than any in the western parks, as it is believed logical to go farther in road development in an area where travel is bound to be heavy owing to its location in or near the more densely populated portion of the United States. Further high-standard road developments, however, will be consistently opposed, since one of the major duties of the National Park Service is to preserve and protect the natural conditions of the wilderness.

Authority for the construction of the highway in the Shenandoah area before the actual establishment of the park was given to the National Park Service that employment might be provided for the sufferers from drought and adverse economic conditions in the Shenandoah Valley.

THE SPRINGFIELD MUSEUM

ACCORDING to *Museum News* plans for the James Philip Gray Art Museum and for an addition to the Natural History Museum have been accepted by the board of directors of the City Library Association, Springfield, Massachusetts. The plans are by E. L. Tilton and Arthur M. Githens, of New York, and were chosen from a number submitted in competition. They call for two-story structures harmonizing in style and materials with the buildings already on the city library quadrangle, which include the library, the William Pynchon Memorial, the Natural History Museum and the Art Museum. The new art building will be erected on the site now occupied by the George Walter Vincent Smith home; the natural history addition will be on the west side of the quadrangle. The art building will cost about $350,000; the addition to the Natural History Museum, about $160,000.

The James Philip Gray Art Museum will house paintings and will thus provide a much needed supplement to the present art building, which is used principally for decorative arts. Pictures will be purchased with the income from a fund of more than $750,000 bequeathed to the association by Mr. Gray. The natural history addition will furnish needed additional exhibition space, and space for lectures and for the children's work.

Building is expected to begin this summer. The building committee consists of Nathan D. Bill, Edward Kronvall, William B. Kirkham and Hiller C. Wellman. This committee arranged the competition for selecting the architect and named the jury of five to judge the merits of plans submitted. On this jury were Theodore Sizer, of Yale University; Henry R. Shipley and Frederick L. Ackerman, architects of Boston and New York, respectively; Mr. Kirkham and Mr. Wellman, chief librarian of the city library. The successful competitors, Tilton and Githens, have been chosen as architects for the construction of the two buildings.

THE THIRD INTERNATIONAL CONGRESS OF EUGENICS

THE Sixth International Congress of Genetics will be held under the presidency of Professor T. H. Morgan, at Ithaca, New York, in 1932, beginning on August 24. Immediately preceding this congress the Third International Congress of Eugenics will meet in New York City.

According to a statement in the last issue of *Eugenical News*, the First International Congress of Eugenics, which was sponsored by the Eugenics Education Society of Great Britain, was held in London in 1912, under the presidency of Major Leonard Darwin. The second congress in this series was held in New York in 1921, under the presidency of Dr. Henry Fairfield Osborn. The third congress will be held at the American Museum of Natural History, New York, from August 20 to 23, 1932, under the presidency of Dr. Charles B. Davenport, director of the Department of Genetics of the Carnegie Institution of Washington and organizer of the Eugenics Record Office.

The first congress in 1912 set up a Permanent In-

ternational Eugenics Committee which built up the international collaboration which made the second congress possible. This Permanent International Eugenics Committee was changed, in 1921, to the Permanent International Eugenics Commission, which in 1925 developed into the present International Federation of Eugenic Organizations, which, among other functions, fosters collaboration among the several nations in their eugenical researches between congresses, and sponsors international congresses from time to time. Dr. Davenport was formally selected as president of the third congress by the ninth meeting of the International Federation of Eugenic Organizations which met at Farnham, England, in September, 1930. This same meeting of the federation duly committed to the American delegation the function of organizing and managing the third congress. In response to these two votes of the federation, Dr. Davenport called the American delegation together at the Yale Club last November. This delegation, by vote, formally accepted the responsibility and, in accordance with the actions already taken by the federation and the authority granted, perfected and announced the following working organization and preliminary plans for the congress.

President—Charles B. Davenport, Cold Spring Harbor, Long Island, N. Y.

Honorary Presidents—Leonard Darwin, Henry Fairfield Osborn.

Vice-presidents—Victor Delfino, Argentina; H. Reichel, Austria; A. Govaerts, Belgium; D. F. Ramos y Delgado, Cuba; V. Růžička, Czechoslovakia; Sören Hansen, Denmark; A. Lüüs, Esthonia; Harry Federley, Finland; Georges Schreiber, France; Alfred Ploetz, Germany; Sir Bernard Mallet, Great Britain; Corrado Gini, Italy; Marianne Van Herwerden, Netherlands; Jon Alfred Mjøen, Norway; Leon Wernic, Poland; N. K. Koltzoff, Russia; H. B. Fantham, South Africa; H. Lundborg, Sweden; O. Schlaginhaufen, Switzerland; Irving Fisher, United States.

Treasurer—Frederick Osborn, 52 Broadway, New York, N. Y.

Secretary—Harry H. Laughlin, Cold Spring Harbor, Long Island, N. Y.

Chairmen of Administrative Committees—Scientific Papers and General Program, Charles B. Davenport; Entertainment, Mrs. Charles Cary Rumsey; Finance, Frederick Osborn; Exhibits, Harry H. Laughlin; Publication and Publicity, Leon F. Whitney.

Managing Committee—Charles B. Davenport, *chairman;* Irving Fisher, *vice-chairman;* Clarence G. Campbell, Madison Grant, Frederick Osborn, Leon F. Whitney; Harry H. Laughlin, *secretary.*

An exhibition covering the present status of eugenical research will be held at the museum. It is planned to open this exhibition on August 22, and to continue it, open to the public, until September 22.

The members of the congress will be taken on an excursion to Cold Spring Harbor on Sunday, August 21, to visit the Eugenics Record Office and the Station for Experimental Evolution which, together, constitute the Department of Genetics of the Carnegie Institution of Washington.

SCIENTIFIC NOTES AND NEWS

SIR ALFRED EWING, lately principal and vice-chancellor of the University of Edinburgh and previously professor of applied mechanics at the University of Cambridge, has been nominated as president for 1932 of the British Association for the Advancement of Science.

THE Hillebrand Prize of the Chemical Society of Washington has been awarded to Dr. Claude S. Hudson, of the U. S. Public Health Service, with special reference to his work on the ring structure of sugar.

THE Society of Arts and Sciences, New York, has awarded its 1931 medals for "outstanding scientific achievement" to Dr. Harlow Shapley, director of Harvard College Observatory, and to Dr. William Crocker, director of the Boyce Thompson Institute for Plant Research.

THE American Geographical Society announces the award of the David Livingstone Centenary Medal to Captain Hjalmar Riiser-Larsen, for his work in the Antarctic as leader of the *Norvegia* expedition in 1929–1930. He has returned to the Antarctic, joining the *Norvegia* early this year, to take charge of the latter part of the season's work. Captain Riiser-Larsen has also participated in two notable Arctic expeditions—the Amundsen-Ellsworth Polar Flight of 1925 and the flight of the *Norge* across the Polar Sea in 1926.

AT a dinner of the directors of the American Institute of Mining and Metallurgical Engineers held last November, Dr. Henry S. Drinker, president emeritus of Lehigh University, was presented with a gold watch bearing the following inscription: "Henry Sturgis Drinker—Founder—American Institute of Mining and Metallurgical Engineers from his appreciative fellow members—1930." Dr. Drinker observed his eightieth birthday on November 8, 1930.

A DINNER in honor of Professor E. B. Wilson, as retiring president of the Social Science Research Council, was given at the University Club, New York,

on the evening of March 27. The speakers included Professor Charles E. Merriam, of the University of Chicago; Professor Wesley C. Mitchell, of Columbia University; Dr. Waldo G. Leland, permanent secretary of the American Council of Learned Societies; Dr. John C. Merriam, president of the Carnegie Institution of Washington, and Professor Arthur M. Schlesinger, of Harvard University, who presided.

AT the recent meeting in Baltimore of the American College of Physicians, Dr. S. Marx White, president-elect of the college, was inducted as president. Dr. Francis M. Pottenger, of Monrovia, California, president and medical director of the Pottenger Sanatorium, was chosen president-elect for 1932. He will assume office at the meeting next year at San Francisco. Other officers elected were: *First Vice-president,* Dr. Alfred Scott Warthin, of Ann Arbor, Michigan; *Second Vice-president,* Dr. Charles G. Jennings, of Detroit; *Third Vice-president,* Dr. John A. Lichty, of Clifton Springs, New York.

A HARVARD CHAPTER of Sigma Xi was inaugurated on March 28. Professor Harlow Shapley, of Harvard College Observatory, presided, and Professor George W. Stewart, national president of the society; President Lowell; Dr. Karl T. Compton, president of the Massachusetts Institute of Technology; Professor Walter H. Snell, of Brown University; Professor Jerome W. Howe, of the Worcester Polytechnic Institute, and Professor John S. Nicholas, of Yale University, spoke. Professor Shapley was elected president of the chapter and Professor Kirtley F. Mather secretary.

DR. T. WAYLAND VAUGHAN, director of the Scripps Institution of Oceanography, University of California, at La Jolla, has been elected a member of an advisory committee on the "General Bathymetric Chart of the Oceans" of the International Hydrographical Bureau of Monaco.

PROFESSOR KARL GOEBEL, director of the botanical garden of the University of Munich, has been invited to be Speyer visiting professor at the Johns Hopkins University for 1931–32.

PROFESSOR HOWEL WILLIAMS, at present in California, has been appointed professor of geology at the University of Wales, Aberystwyth.

DR. E. E. CLAYTON has resigned his position as associate in research in the department of botany of the New York Agricultural Experiment Station to become plant pathologist in the Office of Tobacco Investigations of the U. S. Department of Agriculture.

DR. WILLIAM C. YOUNG, instructor in biology at Brown University since 1928, has received a National Research Council fellowship for study abroad and will continue his work under Professor von Mollendorff at the University of Freiburg, Germany, next year. He is a graduate of Amherst in the class of 1921.

THE J. T. Baker Chemical Company Research Fellowship in Analytical Chemistry, Midwest Division, has been awarded to H. C. Fogg, formerly instructor in chemistry at the University of New Hampshire. He will work at the University of Michigan under the direction of Dr. H. H. Willard.

DR. R. B. LINDSAY, associate professor of physics at Brown University, has accepted an invitation to offer a graduate course in acoustics at the Polytechnic Institute of Brooklyn in the second semester of the academic years, 1931–32. He will go to the institute as visiting professor of theoretical physics.

DR. FRANK B. COTNER, associate professor of botany and bacteriology in Montana State College, will during the coming summer be a member of the staff of the department of botany at the University of Michigan. Dr. Cotner is acting head of the department of botany and bacteriology during the present academic year in the absence of Professor D. B. Swingle, who is on sabbatical leave at the University of Wisconsin, where he is engaged in research work.

DR. HARRY H. LOVE, professor of plant breeding at Cornell University, has left for China, where, during the next three years at the University of Nanking, he will organize plant improvement projects for the Chinese Government, under the auspices of the joint Cornell-Nanking University-International Education Board. The Chinese Government is preparing to take over full control of the work of this organization.

MR. M. W. STIRLING, chief of the Bureau of American Ethnology, has been excavating a mound on Horr Island off the west coast of Florida. Toward the end of March he planned to go to Cape Canaveral to look over some sites, thence to Miami and by airplane to Haiti, where he will join Dr. Wetmore, Mr. Parish and Mr. Krieger on a short visit to the archeological sites found by Mr. Parish on Vache Island. Mr. Stirling is expected to return to Washington the early part of April.

DR. ROY CHAPMAN ANDREWS sailed on March 28 for China to search on the plains of eastern Mongolia for the fossils of the pre-Peking man.

DR. SAMUEL W. STRATTON, chairman of the corporation of the Massachusetts Institute of Technology and formerly director of the United States Bureau of Standards at Washington, sailed on March 28 for Europe. He goes to Paris, where he will be the representative of the government at the forthcoming meeting of the International Committee of Weights and Measures. This conference will be held at the In-

ternational Bureau of Weights and Measures at Sèvres from April 10 to April 22. Dr. Stratton will return to America immediately after the conclusion of the meeting.

DR. WILLIAM H. WELCH, of the Johns Hopkins University, gave the principal address at the annual banquet of the American College of Physicians meeting at Baltimore.

DR. THEOBALD SMITH was a visiting lecturer at the School of Tropical Medicine in San Juan, Porto Rico, during a two-week period in March. He gave a series of lectures to the faculty and students and studied the medical problems of the island. Dr. Walter W. Palmer, Bard professor of medicine at the College of Physicians and Surgeons, Columbia University, visited the school for ten days in March, giving several lectures and holding clinics at the University Hospital.

DR. M. M. LEIGHTON, chief of the State Geological Survey of Illinois, addressed the St. Louis University Sigma Xi Club on March 17, on "Recent Studies Bearing on the Chronology of the Glacial Deposits of the Mississippi Valley States."

DR. WALTER R. MILES, professor of psychology in Stanford University and visiting research professor of medicine in Yale University, on March 25 addressed a graduate seminar in psychology at Brown University on "Visual Fixation." In the evening he delivered a Marshall Woods lecture on "Dilute Alcoholic Beverages and Human Behavior."

DR. HERBERT A. EVANS, of the University of California, who was to give the Bacon lectures at the University of Illinois College of Medicine on March 31 and April 1, is suffering from an attack of influenza, and was unable to give the lectures as announced.

THE 1931 Messenger Lectures at Cornell University will be given in April by Dr. Thomas H. Morgan, director of the William G. Kerckhoff Laboratories of the Biological Sciences at the California Institute of Technology. The series, which has for its subject "The Experimental Study of Organic Evolution," will comprise twelve lectures, starting on April 9 and continuing until April 24. The Messenger Foundation, established in 1923 through a bequest of about $77,000 in the will of Dr. Hiram J. Messenger, of Hartford, Connecticut, provides for an annual course of lectures on some phase of the evolution of civilization, "for the special purpose of raising the moral standard of our political, business, and social life." Professor Morgan will speak on the following twelve topics: The Mutation Theory and its Chromosomal Background; The Cellular Basis of Heredity and Evolution; Mendelian Inheritance and Its Bearings on the Evolution Theory; Artificial Selection, Mutation and Evolution; Adaptation and Natural Selection; Variability and Selection; The Theory of Sexual Selection and Hormones; Embryonic Development and Its Relation to Evolution; The Inheritance of Acquired Characters and Mutation; The Social Evolution of Man: Nature and Nurture; Evolution as a Response to the Order of Nature; Mechanistic and Metaphysical Interpretations of Biology and Evolution.

FOR the third year the Geographic Society of Chicago is offering a research series of three lectures in Fullerton Hall of the Art Institute of Chicago. The titles for 1931 are as follows: Dr. Darrell H. Davis, the University of Minnesota, "Facts of the Human Habitat in the Central Northwest"; Dr. Robert B. Hall, the University of Michigan, "The Yamato Basin," and Dr. Wellington D. Jones, the University of Chicago, "Land Occupance in Dairy Farming Communities Adjacent to Metropolitan Chicago."

AT the Vanderbilt School of Medicine lectures have been arranged as follows: On March 31 by Dr. George R. Minot, professor of medicine at the Harvard Medical School, under the auspices of the Alpha Omega Alpha Honorary Society; on April 16 by Dr. Charles R. Stockard, professor of anatomy at the Cornell Medical School, under the auspices of the Phi Beta Pi fraternity, which has established an annual lectureship; on April 4 by Dr. G. F. McCleary, of the British Ministry of Health, who will speak on "The Control of Narcotic Drug Addiction." Dr. McCleary is coming to this country primarily for the purpose of delivering one of the DeLamar Lectures at the Johns Hopkins University School of Medicine.

THE annual joint meeting of the Wisconsin Academy of Sciences, Arts and Letters, the Wisconsin Archeological Society and the Midwest Museum Conference will be held at Ripon College on April 10 and 11. An illustrated lecture on North African Ethnology will be given by Alonzo W. Pond on the evening of the tenth.

PROFESSOR GEORGE T. HARGITT, Duke University, Durham, North Carolina, secretary of section F of the American Association for the Advancement of Science, writes that in connection with the summer meeting of the association in Pasadena from June 15 to 20, Section F (Zoology) will hold such sessions as are necessary for the accommodation of papers presented by its members. The following information should be furnished by those desiring a place on the program: Title of paper; abstract of about 200 words; charts or lantern to be used; microscopes needed for demonstration; under what group the paper should be listed—physiology, embryology, cytology, comparative

anatomy, genetics, parasitology, protozoology. Papers will be limited to 15 minutes. Such information should be sent direct to Dr. Bennet M. Allen, department of zoology, University of California, Los Angeles, who is in charge of the program arrangements. Titles, abstracts and other information must be in his hands not later than May 15.

THE twenty-fifth annual convention of the Illuminating Engineering Society will be held in Pittsburgh, Pennsylvania, from October 13 to 16, inclusive, 1931. Headquarters will be established at the William Penn Hotel. As in previous years, a preconvention session of Lighting Service Engineers will be held on the day preceding the official opening of the convention. A special feature of this year's meeting will be the observance of the society's silver anniversary.

THE scientific session of the American Heart Association will be held on June 9, from 10:00 A. M. to 5:00 P. M., in the Main Surgical Clinic of the Pennsylvania Hospital at Eighth and Spruce Streets, Philadelphia.

Nature, quoting from *Chemistry and Industry*, states that the International Atomic Weights Commission will meet for the first time since the war. The Federal Council for Chemistry, in view of the progress made in ensuring the truly international character of the Union Internationale de Chimie, has decided to dissolve the existing committees on the chemical elements and to appoint a new international committee. This is to consist of G. P. Baxter (United States), O. Hönigschmid (Munich), P. Lebeau (Paris), R. J. Meyer (Berlin), and Mme. Curie. Professor G. Urbain has been elected honorary president of the committee, which has been charged with the duty of preparing an annual international table of atomic weights. New committees on isotopes and radioactive elements are in course of formation.

IT is estimated that £700,000 will eventually become available for cancer research as a result of a provision in the will of Montague Stanley Napier, motor car manufacturer and airplane designer, who died in Cannes in January.

MRS. MARY E. LIBBEY, widow of Dr. William Libbey, of Princeton University, has made a gift of $6,000 to the Graduate School of Geography at Clark University. She had already given $1,000 and Dr. Libbey's collection of geographical instruments, a special card catalogue and a collection of 14,000 lantern slides to found the Libbey Memorial Library at the university.

ACCORDING to *Nature* an experimental room has been set up at the London School of Hygiene and Tropical Medicine in which it is possible to reproduce by means of an air-conditioning plant varied climatic conditions and any temperature, humidity or air movement which may occur in factories or mines. Experimental subjects rest or work under the conditions to be investigated, and by observation of the pulse, body temperature, skin temperature, loss of weight due to sweating, and expenditure of energy by measuring the air breathed and oxygen used, it is possible to study the effect of such air conditions on the human body.

Museum News reports that the government program for improvements in the City of Washington includes the demolition of the Army Medical Museum building which is on the Mall near the Smithsonian Institution. The exhibits will be transferred to a new building to be erected at the Walter Reed Medical Center, if tentative plans formulated by the War Department are put into effect.

THE will of Egbert C. Fuller, president of the E. C. Fuller Company, of New York, who died at New Haven on March 5, provides for the establishment of a fund which the executors estimate will reach $1,500,000, to be used "for alleviation of suffering from disease and especially for the control of cancer." Mr. Fuller, in his will, directed that the fund be known as the Anna Fuller Fund, in memory of his wife, who died from "this painful disease." The fund may be used according to the will only for research as to its cause, treatment and care; the education of the public as to its prevention and treatment and the actual treatment of persons suffering from the disease. While there is hope of preventing cancer, Mr. Fuller provides in his will that the fund shall not be used for the treatment of persons suffering with the disease "except as incidental to such research and education." The will also provides for the creation of the Anna Fuller memorial prize which is to be given to any person or persons who "make a real and outstanding contribution to knowledge of the cause, care and prevention or cure of cancer." Such award or awards shall not in any five-year period exceed the sum of $25,000. Prizes are to be awarded upon the recommendation of the president of the American Medical Association, the dean of the Johns Hopkins Medical School, and the dean of the Harvard Medical School.

CONTROL of the Sully's Hill area in North Dakota was transferred from the National Park Service to the Department of Agriculture by legislative enactment shortly before the adjournment of Congress. The area, established as a national park in 1904, has never been actively administered by the National Park Service. Although a picturesque forested tract, once the scene of a famous Indian battle, it is lacking in those outstanding natural features of national importance

so essential to national parkhood. For many years the Bureau of Biological Survey of the Department of Agriculture has maintained a game preserve in the area and has financed all improvements made there. The superintendent of the Fort Totten Indian School, through the courtesy of the Bureau of Indian Affairs, has served as acting superintendent of the Sully's Hill Park without cost to the National Park Service.

THE Beit Railway Trust has completed its scheme of fellowships for the two Rhodesias. In order to provide opportunities for young men in Rhodesia to undertake post-graduate studies, the trustees offer three post-graduate fellowships annually tenable for two years at universities, or for special studies at institutions approved by the trustees, in South Africa, Great Britain, the Oversea Dominions, the Continent of Europe, or the United States. The value of a fellowship is £250 per annum, if held in South Africa, and £375 per annum if held oversea. If the course described by a candidate at an approved institution is obtainable in South Africa, preference will be given to that country. Candidates must hold a recognized university degree, be unmarried, and be of European descent through both parents. They must not have passed their twenty-sixth birthday on the date of application and must have resided in Northern or Southern Rhodesia for three full years before the date of application, save that, where a candidate has spent all or part of that period outside Rhodesia in a university or university college, his parents must have resided in Rhodesia for at least five years before the date of application. The administration of the fellowships will be in the hands of an advisory board, of which the chairman will be the Governor of Southern Rhodesia. It is pointed out that out of the funds provided by the will of the late Otto Beit it will now be possible for a boy who begins his education in a Rhodesian primary school to obtain assistance through the secondary school to a South African university and thence to a university or technical institution in Great Britain, the Oversea Dominions, the continent of Europe, or the United States. Sir Alfred Beit has been appointed a Beit Railway Trustee in succession to his father, the late Sir Otto Beit.

THE discovery of element 75, rhenium, was announced by the German chemists, Walter Noddack and Ida Tacke, in 1925. The first actual evidence of its existence was the finding of three or four new lines in x-ray spectra. Through the donation of 1 gram of pure potassium perrhenate to the Bureau of Standards by Dr. A. V. Grosse, of the Institute of Technology, Berlin, a study of the emission spectrum of the new element was made possible. Measurements have now been made by W. F. Meggers at the Bureau of Standards of the arc spectrum of rhenium in the region from 2,300 A in the ultra-violet to 8,800 A in the infra-red. Approximately 2,000 lines have been discovered, all of which are new to the science of spectroscopy, since they are not identifiable with lines emitted by any other known atoms.

THE proceedings of the celebration of the three-hundredth anniversary of the first recognized use of cinchona, held at the Missouri Botanical Garden, October 31 and November 1, 1930, are now ready for distribution. This volume will consist of about 250 pages containing a complete account of the celebration, and will include in addition to scientific papers the dinner speeches by Judge George C. Hitchcock, President, Board of Trustees, Missouri Botanical Garden, presiding; Dr. C. E. Caspari, Dean, St. Louis College of Pharmacy, St. Louis, Missouri; Mr. W. D. Besant, Director of Parks and Botanic Gardens, Glasgow, Scotland; Dr. George D. Rosengarten, Past President of American Chemical Society, Malvern, Pennsylvania, and Dr. A. R. Van Linge, N. V. Nederlandsche Kininefabriek, Maarssen, Netherlands.

The Wistar Institute News reports that owing to the excessive space required in *The Anatomical Record* to print the abstracts of papers presented at the meetings of the American Association of Anatomists and the American Society of Zoologists, the proceedings of these meetings, and the membership lists, it has seemed best to issue four supplements to the *Record* in each year. One supplement would carry the abstracts of papers to be presented at the meetings of the American Society of Zoologists. Another the proceedings and membership list of this society. The third supplement would contain the abstracts of papers to be presented at the meetings of the American Association of Anatomists, and the fourth supplement would contain the proceedings of the meetings and membership list. By this means the publication of original research material will not be delayed.

THE National Forest Reservation Commission on February 25 approved the purchase of 254,022 acres in 19 states, to cost $1,186,159.40, for incorporation into national forests. The commission is composed of Ray Lyman Wilbur, Secretary of the Interior; Arthur M. Hyde, Secretary of Agriculture; Patrick J. Hurley, Secretary of War, chairman; Senators Keyes (Rep.), of New Hampshire, and Harris (Dem.), of Georgia; and Representatives Hawley (Rep.), of Salem, Oreg., and Aswell (Dem.), of Natchitoches, La. Preliminary purchase agreements, including prices, have been made. The lands involved comprise 290 tracts in 26 purchase units or national forests, a purchase unit being a tract designated for purchase for inclusion in a national forest or for establishment of a

new forest. The purchase approved in the Green Mountain unit in Vermont is the first in that unit, which eventually will be a national forest. The commission also discussed establishment of three new purchase units in Wisconsin, but no action was taken on them.

DISCUSSION

ERRONEOUS CITATIONS AND TITLES OF SCIENTIFIC PAPERS

EXPERIENCES in connection with the editorial supervision of scientific papers sent in for publication in standard journals, and in connection with the use of literature lists published in other journals, have revealed and emphasized two weaknesses on the part of investigators, which should be considered seriously by every author who attempts to publish an account of his work, and by every editor responsible to the public for the kind of service he renders.

The most discouraging feature of manuscripts, just as they are received from the authors, is the lack of accuracy in citation of pertinent literature, caused by a common failure to check up the citations with the original papers. *It is never safe to copy a citation from some other author's literature list.* Without casting reflections upon any author in particular, I wish to cite a couple specific cases to illustrate this point. Here is a paper by S. S. ZILVA, on "The Action of Ultra-Violet Rays on the Accessory Food Factors," published in the Biochem. Jour. **13**: 164–171. 1919. ZILVA cites STEENBOCK, BOUTWELL and KENT as Jour. Biol. Chem. **36**: 577. 1918. On looking up this citation, I found myself in the midst of a paper by HARDEN and YOUNG on "Action of Enzymes on Human Placenta." The correct citation for the STEENBOCK paper is Jour. Biol. Chem. **35**: 517–526. 1918.

Another example may be chosen from the Biochemical Journal, but might be duplicated from any journal. WEBSTER and HILL, in a paper on "The Supposed Influence of Irradiated Air on Growth," Biochem. Jour. **18**: 340–346. 1924, cite STEENBOCK and NELSON as Jour. Biol. Chem. **61**: 355. 1923. On going to this journal, I found a paper by Petrén on "Low Nitrogen Metabolism with Low Carbohydrate Diet in Diabetes." The STEENBOCK and NELSON article was finally located in volume **56**: 355–373. 1923, after searching the indices of five volumes.

These are not isolated cases. Everyone who attempts to examine the literature cited in scientific papers will almost immediately run into aggravating difficulties because of the lack of care of authors who are too anxious to publish to take proper time with this indispensable adjunct to a good paper—the literature cited. As an editor with some years of experience in handling publication of papers, I have found it necessary to check up on *all authors*. There is seldom a paper handed in that is free of erroneous citations. In some few cases the citations have been 100 per cent. in error, *even when the author was citing his own work!* To give more concrete quantitative data concerning this evil, a check has been made on a series of papers handled during 1930. The batting average for whole numbers of a publication is approximately 54 per cent. in the cases examined. Forty-six per cent. of the citations needed correction in some way or other. The errors are of numerous kinds, including misspelled names of authors, wrong initials of authors, omission of parts of titles, or substitution of words in titles, change of singular to plural or *vice versa*, omission of umlauts in German titles and of accents in French, failure to capitalize German nouns, capitalization of German adjectives, errors in name of journal, errors in volume number, omission or errors in page limits, error in or omission of year of publication, etc., etc. Every conceivable error that can be made is being made daily by authors, and most of them seem to be utterly unconscious of bad technique in this connection. Or perhaps they think: What's the use of having an editor, if not to do these chores?

Since very few editors take the time and trouble to check up on these errors of citation before publication, the literature lists published during recent years are full of erroneous citations, and it is for this reason that it is never safe to copy a citation from such a list. Nothing but consultation of the original source can insure accuracy, and every author who cites literature should take enough pride in his work to insure accuracy in the literature citations.

The other point of weakness which needs to be considered by authors of papers is the advertising of series of papers through double titles. Turning to a recent literature list in Plant Physiology, we find the following: "Some influences of the development of higher plants upon the microorganisms in the soil. III. Influence of the stage of plant growth upon some activities of the organism." And from the Annals of Botany comes this title: "Observations on the anatomy of teratological seedlings. I. On the anatomy of some polycotylous seedlings of *Cheiranthes cheiri*." Occasionally authors write in asking to change a perfectly good simple but adequate title to one of these long double titles that require three lines to cite, whereas the simple one requires but one. One wonders why an author should desire these long titles, with constant duplication of the first half. Does he imagine that it is impressive of his prolific authorship

to place XVIII in the midst of a title, and that it would be still more impressive if it reached LXXXVIII? Or will the list of titles not occupy enough space in the 70th year Festschrift unless they are made of double length?

There is surely no good reason for this double title vogue. It is a mischievous habit which should be consistently repressed, not by editors, but by the authors, themselves. Titles should be made as short as they can be made without concealing the nature of the work, in the interests of economy of publication. And every title should be distinct enough to prevent confusion. Occasionally identical titles are used for two different papers. Such papers are easily confused, and wrong citations may be given without authors being aware that they are in error. It is not a difficult matter to select concise and adequate titles of a few words in length. It saves much time in type setting, and much costly space, to make them brief.

As these problems have forced themselves to my attention repeatedly, they are mentioned in the hope that authors who prepare papers for the scientific press will make some effort to cooperate in a difficult situation. Formulation of short titles, and accuracy in citation, would lighten some of the burdens resting upon the publication department of scientific work.

C. A. SHULL

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A FURTHER COMMENT ON THE "PUMPING" HABIT OF PLANT LICE

HAD the writer of the article appearing in SCIENCE, 72: 560, November 8, 1930, entitled "Plant Lice Pumping in Unison," substituted the word "jumping" for "pumping" he would be more nearly correct in describing the synchronous movements of the members of certain aphid colonies. Instead of the described behavior, which has probably been observed with many species of aphids, on many plants by many entomologists, being explained as one of pumping action it is undoubtedly a response to external stimuli. It is a reaction to danger, to shake off or frighten away the small parasitic flies and wasps attempting to place an egg in or on the aphid's body. With the approach of danger or with slight mechanical stimuli, as jarring, the aphid is disturbed and twitches its body laterally or dorso-ventrally without withdrawing its mouthparts from the plant. The wave of twitching is observed to move along the stem as it is taken up by the other members of the colony. It is not a movement performed simultaneously by all members of the colony.

F. M. Webster and W. J. Phillips, in their treatise on the spring grain aphis (*Toxoptera graminum* Rond.) (U. S. Dept. Agr., Bureau of Entomology Bulletin 110, September, 1912), describe the activity of the parasite *Aphidius testaceipes* Cress. among colonies of this aphid. The parasite is said to show little or no fear while among young nymphs but if she is among a number of adult Toxoptera and they begin to kick up their abdomens, she often hurries away, apparently in alarm (p. 106). An aphid, after being pierced by the ovipositor of this parasite (p. 105) or by that of *Aphelinus nigritus* How. (p. 124), is observed to "kick up" her abdomen as if suffering pain and a droplet of liquid often appears at the point of puncture or at the ends of the cornicles. F. M. Wadley and J. A. Hyslop called attention to the above record on *T. graminum* and also kindly furnished notes on the habits of the following species of aphids. They found that mechanical irritation produced occasional jumping in *T. graminum* but did not observe such a response to similar stimuli among colonies of *Brevicoryne brassicae* L., *Aphis rumicis* L., *Rhopalosiphum prunifoliae* (Fitch), or *Illinoia pisi* (Kalt.). In addition these workers have substantiated the observations of the present writer in several instances where jumping has been noted among individuals in colonies of *Prociphilus imbricator* (Fitch) on beech, *Macrosiphum ambrosiae* (Thomas) on ragweed, *M. rudbeckiae* (Fitch) on golden glow, *M. pelargonii* (Kalt.) on cranesbill, *Aphis illinoiensis* (Shimer) on grape, *Macrosiphonella sanborni* (Gillette) on chrysanthemum, and *Aphis coreopsidis* (Thomas) on cosmos and beggar-tick. *Cerosipha rubifolii* (Thomas) on blackberry, and *Aphis rubicola* Oestlund (*A. rubiphila* Patch), *Amphorophora rubi* (Kalt.), and *A. sensoriata* Mason on raspberry, have not been observed to display this habit. From these observations it appears that this jumping habit is present in species of various habits and of various genera and is rare or absent in other species of the same habits and genera. It is apparently not essential to feeding, since representatives of both groups increase with approximately equal rapidity.

The present writer, in his studies on the feeding habits of certain Homoptera, leafhoppers and aphids, has failed to discern any external evidence of "pumping" of sap by any of the species with their beaks in place. The act of insertion of the mouthparts by an aphid or leafhopper into the plant tissues and the extraction of the plant sap calls into play delicate muscles located within the head. The external evidence of such muscular activity would be quite different from that violent action alluded to in the above mentioned article, from which it might be concluded that the aphid's body functioned as a bulb on an atomizer or hand syringe.

FLOYD F. SMITH

U. S. BUREAU OF ENTOMOLOGY

THE DIVINING ROD

I HAVE been much interested by Dr. C. A. Browne's article, "Observations upon the Use of the Divining Rod in Germany," appearing in SCIENCE for January 23. It recalls a somewhat similar experience of mine.

For many years a citizen of a neighboring town served this and other communities by using the divining rod to locate supplies of water. In order to settle a friendly argument regarding the existence of this mysterious power, a friend of mine persuaded the dowser to submit himself to a series of tests.

He used forked sticks of any kind of wood, but preferred pear or cherry. His procedure was to walk straight ahead across the chosen field holding the forked stick tilted a little forward, pointing not quite vertically upward. The forks were held in his hands as shown at A, not B, on page 84 of Dr. Browne's article. Presently the stick would bend forward and gradually point downward. Where it was vertical, there a water course existed, the dowser said. A stake was placed there. The process was repeated some distance away, the man walking along a line parallel to the first. Then the line of the water course was determined by walking from one stake to the other following the line where the divining rod continued to point downward. By the same process a second water course was located which intersected the first. The point of intersection was the place to dig the well. He performed this experiment on the college campus in the presence of my friend, myself and a few interested observers.

The usual variations were tried, such as having some one else hold one fork while the dowser held the other, with the usual success. The man was honest, and sincere in his belief that he possessed a mysterious power. He accounted for it by saying that he was very electrical.

Watching his hands during the tests, I soon saw that the bending of the rod was produced by the motion of his right hand. The forearm rotated, bringing the thumb upward and over toward the left hand. The left hand remained stationary. Apparently he was entirely unaware of the fact until it was shown him. When he allowed some one else to hold one fork of the rod, he had always retained the right-hand fork. We then had him retain the left hand fork with one of us holding the right hand one and the rod showed no tendency to bend over.

Other tests were then applied. He was blindfolded and led across the line he had established as showing the water course. Sometimes the divining rod bent over at that line. About as frequently it failed to do that, but bent over at some other place. We had him walk across and then along a blind ditch in which we knew water was flowing. The rod paid no attention to it.

His method of finding lost articles was to put a piece of the same substance at the tip of the rod and then walk about, holding the rod in the same manner as when searching for water. My friend loaned his silver watch for the test. It was concealed in the grass. The dowser stuck a silver quarter in a slit at the end of the rod and began the search. The results were what might be expected. My friend regained his watch later on, but not by that method.

Certain inferences seem well justified. The material of the rod is of no consequence. It serves as an indicator only. The wrist motion of the dowser, apparently involuntary, perhaps even unknown to him, was wholly responsible for the motion of the rod. Can the dowser have some peculiar sensibility which causes that involuntary muscular action when he is near water? In this case, the failure to respond when directly over the ditch where water was then running casts doubt upon that supposition.

The only possibility remaining, so far as I can see, is that one would find water by digging to a sufficient depth almost anywhere. It is quite possible that the percentage of successes in finding water by this method would be quite as large as that obtained by employing a dowser.

Such frequent occurrence of two underground streams of water, intersecting at approximately right angles and continuing as separate streams after intersection, hardly accords with our knowledge of the usual behavior of water. A method which consistently discovers such streams can not fail to arouse skepticism as to the validity of the claims made for it.

ERNEST C. BRYANT

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THE USE OF THE DIVINING ROD IN GOLD PROSPECTING IN ALASKA

DR. C. A. BROWNE'S interesting article in Number 1882 of SCIENCE, "Observations upon the Use of the Divining Rod in Germany," has brought to my recollection an experience of my own, but in this country.

In 1913 I had a chance to visit Alaska, the purpose of my trip being to familiarize myself with the methods of gold mining as used in Alaska. With introduction cards to local people, given me by my friend, the late Dr. Alfred Brooks, I was able to do more in a few days than otherwise would have been possible in so many weeks. I also enjoyed a most friendly reception by every one with whom I happened to meet during my Alaskan trip. Owing to these facts I had been also able to learn something of the use of the divining rod in Alaska, the use of

which was not widely known, as I found out later in Washington.

My first visit was to the placers a few miles from Nome, operated by one of the most important companies, the exact name of which has slipped my memory. The work was carried on on a rather small scale, and in a few hours the manager of the company had shown me everything that was worth seeing. When we returned to his office, suddenly and to my great surprise and even embarrassment, he said: "Geology and geologists are all right, and they do their best, but in my hunt for gold pockets I have been chiefly dependent on this small instrument." Speaking so, he pulled out from the shelf in the corner of the room a fork-shaped branch of a tree in which I immediately recognized the divining rod of the simplest and most traditional form. Remembering our previous talk with this gentleman, the great respect which he had shown to Dr. Brooks and his collaborators and their geological work, I thought, at first, quite unwillingly, that the manager was trying to have some fun with the foreign geologist. However, I soon realized that he was quite serious. He told me about some tests made with his rod by unbelievers. They had placed a gold coin under the carpet, or pretended that they had, and invited him to locate this coin by means of his rod. If the coin really was under the carpet, the rod would immediately dive, thus showing the position of the coin more or less exactly. The manager was rather modest in his pretensions to find the exact point, but was quite positive that he could locate the coin within a circle of about five feet in diameter. During our talk he held the rod in the traditional way, and suddenly it dived. "I am quite sure," he said, "there is a gold vein under this house, but the trouble is that while by means of this instrument I can discover gold, I am unable to find out how rich the vein would be." Probably this consideration prevented him from tearing down the house to start mining at this particular point. As follows from Dr. Browne's article European operators would be, probably, more successful in this case.

I. P. TOLMACHOFF

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A BANKED RACE-TRACK ILLUSION

WITH the consent of the writer I venture to send the following account of an old experience which I have recently extracted from my friend Mr. Gordon Pennington, a Cleveland engineer.

To keep my promise made this morning, I am going to give you a brief account of my experience on the Luna Park track.

This track, you may recall, was circular, a quarter mile in length, and banked sixty degrees, the banked portion curving gradually to horizontal at the inner edge of the track.

The motorcycles used were light and direct geared and could not be run under thirty-five or forty miles an hour.

When I went out to the track to become a motorcycle racer I had never been on a motorcycle before. On my first experience I rode around the inner edge of the track for several turns at the minimum speed the motorcycle could be held down to. As soon as I became used to this I opened up the throttle, increased my speed and, of course, had to climb up on the sixty degree portion of the track. As I climbed from the more horizontal to the steep portion of the track I was very conscious of the decreasing inclination of my body to the horizontal until, when I had reached the sixty degree section, I had the sensation that my body was almost horizontal (probably was inclined twenty degrees to the horizontal). I was very conscious that I was on my side. I was where I knew I ought to be. My perception was guided by my intellect, not by my internal sensations.

A few seconds after I had reached full speed I experienced the novel sensation I spoke to you about. Suddenly I and my motorcycle seemed to regain the vertical position and, of course, simultaneously the entire track and the field in the center of it, filled with people and automobiles, tilted up at a steep angle. I then found myself racing on a horizontal track (that is, laterally) and at the bottom of a tread mill which seemed to turn under me at just the right speed to keep me always at the bottom.

After my first experience this sensation of being vertical and the rest of the world inclined continued on all subsequent runs, and increased my sense of security on the track. In that first experience, however, when my point of view changed, I was for a few moments completely bewildered, and let my motorcycle travel clear up to the retaining board on the upper edge of the track and very nearly crashed. I suspect that a good proportion of the accidents which have occurred to beginners on these circular tracks have been the result of this moment of bewilderment which I assume that others have experienced in the same way that I did.

When I read this letter to a colleague in the laboratory, one of us said "Gestalt," and spoke of a period of physiological adaptation. The other said "Relativity or Frames of Space" and maintained that the adaptation was purely mental: "It is not like a case of the retina getting modified to function in a different light, or the skin at a different temperature. The otoliths press on the bottom of the rider's labyrinth, his head on his neck, his seat on the saddle, and the wheel itself on the track precisely as they would if the speed of the machine or the curvature of the track were reduced and he were riding practically upright along a flat path."

Both agreed with Mr. Pennington that the "illusion," once accepted, was useful. The one vital problem was to maintain his balance and hold the track, and the more simply and familiarly he could interpret his bodily feelings the easier that was, however topsy-turvy it might seem to make the world beyond. All of which may leave one wondering: When is an illusion not an illusion?

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SOCIETIES AND ACADEMIES

NOTES ON THE REPORT FOR ASTRONOMY AT THE CLEVELAND MEETING

In the reports of the fourth Cleveland meeting of the American Association (Science for February 6, 1931) the paragraph devoted to Section D (Astronomy) on page 152, for which the present general secretary of the association was responsible, is regrettably inadequate in a number of ways. That paragraph was based on an excellent report received from the section secretary, which was itself too long to be included in the special issue of Science that carried the story of the meeting. The amount of space actually allotted to any section or society in such an issue can not be ascertained definitely until all manuscripts for that issue have been assembled, after which much deletion is generally necessary. In this instance notes on some important papers were finally omitted and some inaccuracies were introduced. The secretary of Section D has very kindly prepared the following amendations to the report on the Cleveland sessions of that section.

B. E. L.

In the note on the paper by Seares, Sitterly and Joyner, the kernel was omitted with the deletion of mention of "Eros." The investigation was on the magnitudes and color indices of the comparison stars for Eros, and it was in these that they found discrepancies among various observers.

There was but one paper on the Leonids, and that by Morgan and Calvert, who on the morning of the 17th of November, 1930, observed many meteors from the Leonid radiant, at the maximum 187 per hour. The statement of 20,000 meteorites which reach the earth's surface annually was a general estimate by C. C. Wylie and in no way concerned the Leonids.

In the field of spectroscopy, Miss Cecilia Payne presented a study of the Scorpio-Centaurus cluster, in which she emphasized the need of interpretation of the discordances in the character of lines of the spectra, which occur even in stars of the same type. Pressure and stellar rotation were discussed as causes. The important paper by Struve and Elvey on stellar rotation came as an apt sequel to that of Miss Payne. From the contour of the lines they deduce stellar rotation periods and find that equatorial velocities of 250 km/sec are not exceptional. The method was checked by observing the eclipsing variable Algol by the method first used by Schlesinger. Results were in substantial agreement.

Miss Losh finds that the velocity of the center of mass of Zeta Tauri is variable with a period of 24.6 years and a range of 43 km. The possibility of detecting such long-period variations increases as series of observation are extended.

An interesting variation of usual practice in the computation of spectroscopic orbits of eclipsing binaries was suggested by Carpenter, who proposes the introduction of the time of minimum as determined by photometric observation into the computation. A test case of u Herculis yielded gratifying results.

Bobrovnikoff identifies certain nuclear bands in the spectra of comets with the Raffety bands of the presumably CH molecule. The agreement is not complete. Frequency formulae gave fairly good representation for the remainder of the bands with the CN molecule suggested as the carrier. Berman's studies on the nebular lines at wavelengths 3869 and 3967 indicate their intensity ratio approximately constant in various planetary nebulae. Certain considerations lead to the rejection of C++ as the source, and the author inquires if P++ or Si++ are possibly available.

The remaining papers were brief. Alter presented a study by the method of correlation periodograms of the planetary tidal hypothesis and variation of sun-spot activity. Extension into the future will test the validity of the conclusions, which seem decidedly interesting. Joseph Johnson gave a preliminary report on the solar eclipse of 21 October 1930 as observed at Niuafou. His attention was especially directed to determination of the intensity of various parts of the corona. MacMillan showed some ingenious stereoscopic pictures of star clusters. Mees discussed the characteristics of some new high-speed panchromatic plates developed by Eastman Kodak Company, adaptable to visual refractors. Mehlin gave the result of the test of the objective of the Drake Municipal Observatory, and Dustheimer reviewed the astronomical radio program of WTAM. This station has broadcast 62 astronomical talks in the last six years.

It is expected that the paper on the "Life of Sir Isaac Newton, a Character Sketch," by Louis T.

More, presented at the joint session with Section L and the History of Science Society, will be published in full by the History of Science Society. Failure to mention this carefully prepared paper is the last serious omission.

P. F.

SCIENTIFIC APPARATUS AND LABORATORY METHODS

A METHOD OF MAKING TOPOGRAPHIC MODELS

RELIEF models have recognized advantages over other devices for representing topography. Teachers of physical geography, physiography or geography have found them especially valuable. Models of this type can be readily understood by children as well as by adults; hence their usefulness extends through the entire range of age groups.

One serious limitation in the use of such models is the difficulty of achieving detail and accuracy without spending an undue amount of time in their construction. To overcome these difficulties in part, a device was developed by the writer at Syracuse University when it was desired to prepare a model of the local area for the Natural Science Museum. With the aid of this device, nearly four thousand five hundred square miles of topography, representing central New York, have been completed. Both the accuracy and the amount of detail have proved satisfactory. Since the work was done during spare time, no accurate records were kept of the number of hours required. A fair estimate is that twenty-five square miles of topography of average difficulty may be completed in one hour, after a little experience.

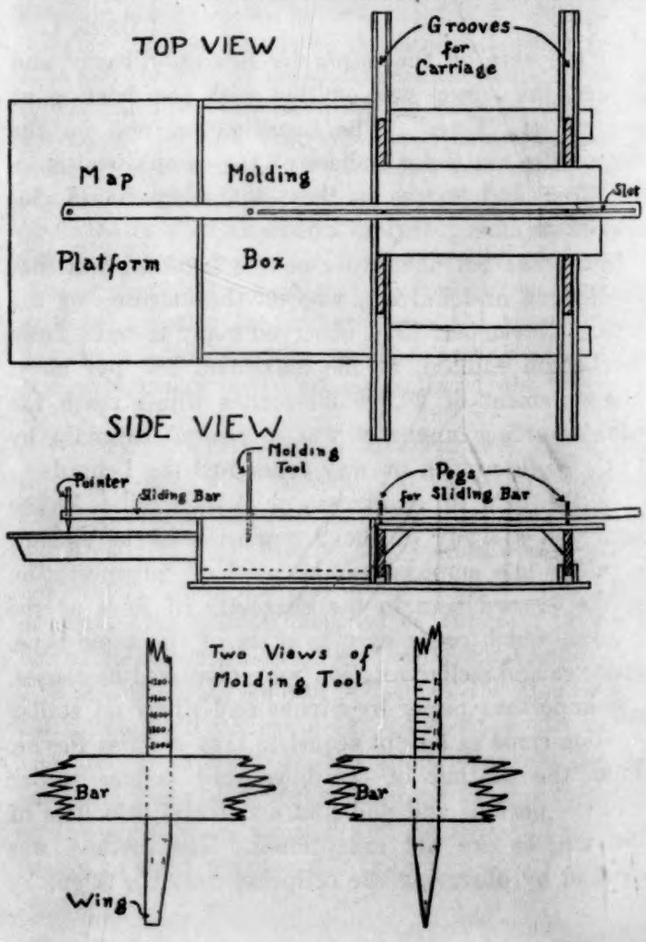
The method consists in making the relief first in molding sand, using a contour map as a guide. Plaster of Paris is then poured over the sand model, and the resulting plate used as a mold from which the permanent model, also of plaster, is cast.

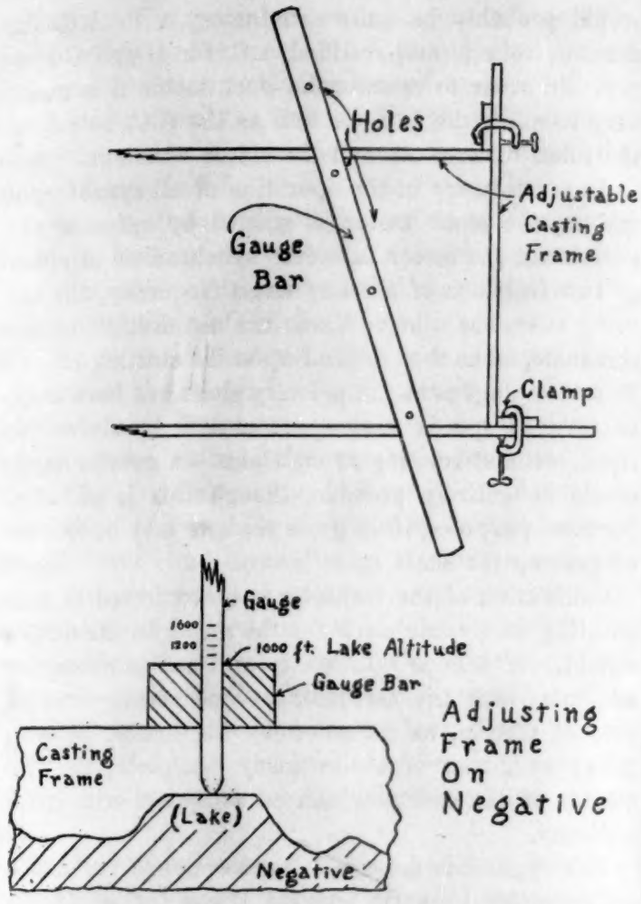
The central unit of the device for making the sand model consists of a box slightly longer and wider than the map, and about two inches deeper than is required for the maximum relief in the area to be represented. This box carries an attached platform at the left hand side on which the map is placed. A sliding carriage is mounted in grooves on the right hand side, free to move forward or backward as far as the limits of the box, but fitting closely in the grooves. This carriage supports a sliding bar which may be moved from side to side. The bar carries a molding tool near its center and a pointer at the left hand end by means of which map locations are transferred to the sand box. The vertical scale is marked on the molding tool. To facilitate the removal of the plaster plate from the sand box, the latter is provided with a false bottom which is lifted out by means of wires attached near each corner.

Much of the effectiveness of a relief model depends on a proper vertical scale. The vertical exaggeration employed on the Syracuse model is approximately 4 1/3. That is, with a horizontal scale from the map of 1/62500, the vertical scale is twelve hundred feet to the inch. This is enough to accentuate the low relief of the Ontario Plain north of Syracuse, and yet not too much for the dissected plateau country to the south.

Procedure: Fill the box nearly full of fine moist molding sand, tamped down firmly. Adjust the map so that when the pointer is moved around the map margin the molding tool will follow around the inside margin of the box. Secure the map in position with thumb tacks.

It has been found best to begin with that portion of the map nearest the operator. Place the pointer successively at each prominent hill top and set the tool each time at the corresponding level. Hold the tool and bar with the left hand, and grasp the carriage with the right. By moving the bar from side to side, and the carriage forward and backward, the excess sand is loosened and may be removed. A teaspoon and a soft brush have been found satisfactory for this purpose. Then select a contour line about a





hundred feet lower and set the tool to throw the sand away from the hill as the pointer follows along the line. It may be necessary to turn the tool as the direction of the line changes. Much care is required to avoid breaking down steep hillsides or narrow ridges. Experience will develop the proper technique. The minor ravines are best done free hand, using either the spoon or the molding tool after determining accurately their positions. If the sand becomes dry and crumbles it must be moistened by careful sprinkling. When the model has been formed, the loose sand grains at the surface should be pressed down with the fingers, being careful not to destroy any part of the work, or to leave concave finger imprints. A thin mixture of plaster of Paris may now be poured gently over the model to a depth of about an inch, or until the hill tops are well covered. The amount necessary will be governed to some extent by the nature of the relief. When it has set firmly it should be loosened from the sides of the box and removed by lifting out the false bottom. The sand may now be cleaned from it by scraping and brushing.

The final cast is made in an adjustable frame. The one used by the writer consists of four separate side pieces, each with a flange at one end by which they are clamped to each other with small clamps. This frame fits closely around the plate or negative, and is supported independently. A gauge is used to adjust the height of the frame. Test the adjustment by sighting across the edges. They must all be in the same plane else the completed cast will not rest on an even base. The surface of the mold must be coated with vaseline or similar substance to prevent the cast from sticking. Fill the frame with plaster of Paris mixed thin enough to fill readily the inequalities of the mold. Use a straight-edged board to smooth the top even with the edges of the frame. Oftentimes it will not be necessary to fill the center of the frame to this level. Use only enough plaster to insure adequate thickness and strength. When dry, the cast may be cleaned and painted in any desired manner.

An important feature of this device is that the completed model has the same horizontal scale as the map from which it is taken. If a pantograph is used to guide the molding tool, the model may be made either larger or smaller than the map, but it is not convenient to reproduce the same scale. The writer has used a large pantograph in this way to increase the scale of models made from maps. It is a satisfactory method, except that the enlarged model calls for a corresponding increase in detail not shown by the map.

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AN OSCILLATOR AND SYNCHRONOUS MOTOR FOR OBTAINING EXACT VARIABLE SPEEDS

WHERE it is desired to have a shaft or disc rotating at a single exact rate, the synchronous motor, following the oscillations of an alternating current, gives an extremely high degree of accuracy. The type of motor employed in electric clocks and that recently described by Wilkins[1] serve that purpose. However, it is often necessary to have the rate of rotation exact, but capable of rapid and convenient variation. The clock motor, though designed to operate on 60 cycle alternating current, can be made to run and vary its speed over a fairly wide range if operated from the output of an oscillator of variable frequency.

The construction of such an oscillator is shown in Fig. 1. A screen grid tube, Type UX-222, is employed as a dynatron in a circuit of the parallel tuned type. This kind of oscillating circuit has the advantage of stability greater than that afforded by the ordinary type of vacuum tube oscillator.[2] If the proper capacities and inductances are used variation of frequency over a wide range is possible. Small inductance, capacity, or both, yield high frequency; lower frequencies are obtainable by the use of larger

[1] H. S. Wilkins, *Gen. Rad. Experimenter*, 1930, 5, No. 5, 3–7.

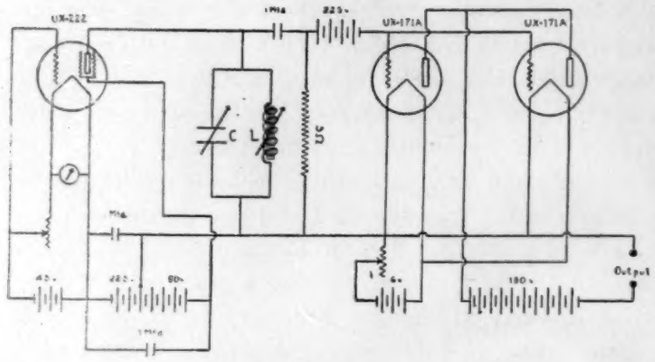

FIG. 1.

inductances and capacities. The frequency in cycles per second is approximately given by the relation: $f = \frac{1}{2\pi\sqrt{LC}}$ where L is the inductance in henries and C is the capacity in farads. A convenient arrangement, if not too great variations of frequency are desired, is one using a constant inductance such as that supplied by the primary of an audio-frequency transformer and variable capacity supplied by a battery of fixed and variable condensers joined in parallel by appropriate keys. A gross change in range may be effected by tapping the inductance or increasing the original amount. If greater accuracy is desired a coil of three or four henries may be wound and substituted for the transformer. Since the frequency of the oscillating circuit is not independent of the voltage supplied to the filament of the screen grid tube it is well to insert a voltmeter in the filament circuit. Maximum efficiency is achieved by operating the filament at the rated 3.3 volts.

The power to run the clock motor is secured from a series of UX-171A tubes in parallel, two being sufficient to take care of small motor loads. Most synchronous clock motors draw about 2 watts; this makes possible the use of dry cell batteries as sources of power. The A and B voltages of the power stage and oscillator have been taken from separate sources, though this is doubtless an unnecessary refinement. With the usual modifications of the circuit, operation would probably be quite satisfactory with A.C. for filament voltage and rectified A.C. for B and C supply. In order to operate the clock motor it is necessary to allow the D.C. as well as the A.C. output of the tubes to flow through the stator windings.

As is necessary in the operation of all synchronous motors, the clock motor is started by spinning the shaft until the motor falls into synchronism at either of two fractions of the impressed frequency, the one being twice the other. These are not difficult to discriminate, since they depend upon the starting torque. In our arrangement the primary shaft has been made to turn at speeds varying from 250 to above 700 r.p.m. without running at multiples. A greater range would be entirely possible, though this is sufficient for most purposes, since gross changes may be effected by gearing the shaft up or down.

Calibration of the oscillator is best effected by substituting an electric clock for the motor in the output circuit. If this is allowed to run ten minutes, for example, with the oscillator at one setting and its rate of motion, as indicated by the hands, be compared with that of an ordinary timepiece, the frequency of the oscillator can be computed with great accuracy.

The apparatus described was developed for use in an experiment on the critical frequency of flicker, where the speed of rotation of a sectored disc must be changed by exactly known amounts. Other uses are apparent. As just described, the method is an excellent one for determining frequency. The rotating disc could be supplied with a contact to interrupt a circuit at definitely variable intervals. The frequency of a second oscillator could be calibrated over a range much higher than the first by connecting the second oscillator to a neon bulb and making it produce a stroboscopic pattern on a disc rotated by the first.

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SPECIAL ARTICLES

A FLOWERING CYCADEOID FROM THE ISLE OF WIGHT

FOLLOWING the notes on the petrified "cycad" trunks of the Isle of Portland given by Dr. Buckland with the advice of the famous botanist, Robert Brown, a hundred years ago, the definitive knowledge of the cycadeoids or flowering cycads begins with Carruthers' description of *"Bennettites Gibsonianus"* from Luccomb Chine on the southeast shore of the Isle of Wight, in 1870. Just when these stem-bearing mature cones were first seen is not so sure. In Wilkins' "Geology and Antiquities of the Isle of Wight" of 1859, there is mentioned as coming from Sandown (a Wealden shore), "an interesting specimen in a nodule with a fracture across it, exposing its fructification with seed vessels, discovered by my friend T. F. Gibson Esq." This is likely the Carruthers type, despite any discrepancy as to locality or horizon;

[2] C. E. Worthen, *Gen. Rad. Experimenter*, 1930, 4, No. 12, 1–4.

although such a specimen does not seem to have been seen as early as the year 1850. Then Robert Brown had remarked that so far as known to him "all the cycad stems from the Isle of Wight differed from those of the Isle of Portland in having a bud in the axilla of each leaf."

Cycadeous stems with a full complement of axillary structures such as Brown seems to have seen are not clearly in evidence in the recorded material from the shores of the Isle of Wight, whether from either the Wealden or the Greensand. Nor have any such since appeared at the Isle of Portland. Albeit, the Chine at Luccomb must ever remain the classic locality of unusual stems, as again proven by a fortunate long hoped for supplementary *find* made by Alfred J. Mew, Esq., of Shanklin, I. W. The "chines" (from the old French and Anglo-Saxon, meaning a cut), are those deep, rugged and picturesque gorges cut back from the shore into either end of the "Undercliffe," a remarkable talus of yet higher rocks stretching along the south shore of the Island for some miles. The Luccomb chine is the first to the east of the Undercliffe, and there, on the beach at the right entrance wall, Mr. Mew made his find about seventeen years ago.

Mr. Mew as a lover of science had long held the very laudable desire of seeing a compact museum unit in his town of Shanklin. But this project seeming to fail of realization, his Luccomb specimen with other material remained by the side until recently. Then, on the occasion of my visit to the Isle of Wight following attendance at the recent International Botanical Congress at Cambridge, through a cordial introduction from a neighbor, Mr. H. F. Poole, after some discussion the suggestion was made and followed to turn the fine specimen over to the Yale collections. Both these gentlemen were fully aware of its interest and promise as one of the handsomest single gifts ever made to Yale. Mr. Poole had also made an important find of a fragment of a trunk still remaining *in situ* in the lower Greensand at a point near by, and about four feet above high tide.

The Mew cycad reached Yale safely, and I have sawn through it longitudinally and transversely, with some lesser cutting, and the smoothing down of the significant tangent surfaces as well, bringing to view the main vegetative and reproductive features in an essential completeness. The stem is a medium sized one bearing its fructifications sparsely, for about the first time. It is 25 cm high by 24 cm on the flat, and 17 cm through on the compressed diameter. The form is distinctly pear-shape due to the thick mass of old frond bases above, amongst which are imbedded young ovulate, and several staminate flower-buds, and at the summit in armor and ramentum 8 to 9 cm deep a splendid crown of fifteen well grown and but slightly emergent young fronds revealing in the transverse section the full pinnule series and structure. The medulla is 10 cm in diameter, the wood and cortex thin. As a specimen this is hence a virtually perfect one, and being quite uneroded it must have been found by Mr. Mew very shortly after rolling down from its matrix onto the upper beach. It even carries on one side a large patch of the lower Greensand rock which, taken with Mr. Poole's *in situ* find, settles at last the position of the most important cycad horizon of the Greensand.

Calcite is the main petrifying material in these petrifactions of the Greensand as more or less associated with stems of conifers. Here and there, though chiefly in the outer armor, are pyritized patches with residual plant carbon. In addition there are in places numerous small pyrite crystals which easily tear out and scratch the surfaces in course of preparation for closer study. There is little direct evidence of siliceous content. But just as some of the darker carbon-containing silicified cycads like *Raumeria* may be etched by hydrofluoric acid and studied by the Walton gelatine-pull method, so here hydrochloric acid is effective. Also, coloration is such as to yield much detail and fine photographs on all smoothed surfaces. Whether the stem is to be referred specifically to *Cycadeoidea* (Bennettites) *Gibsonianus* is not yet quite certain, but probably it is so referable.

This is the first instance of a European cycad bearing a full crown of fronds comparable to those seen in various American specimens. Small fronds found on a very tiny trunk or branch of indeterminate locality yielded to Dr. Stopes excellent histologic details. Also I found on an Isle of Portland *Cycadeoidea microphylla* very young fronds with the bundle series alone indicated. These three instances are thus the only ones in which the fronds have been seen at all in the European petrified series. Therefore, with the three European and six American species of *Cycadeoidea* in which leaves occur, there are in the world nine known species with foliage. All agree in the presence of a varyingly dense mat of hairs borne not alone on the rachis but all over the under surface of the pinnules as first noted by Dr. Stopes, and overlooked by me in the initial instances studied.

The ovulate cones of the Mew cycad, of which there may be a half dozen, are about a scant half centimeter in diameter, by a centimeter long and very prettily calcified. Of the complete flowerbuds two are fairly seen; but as the petalo-staminate disk is much pyritized the features are not so fully preserved as in *Raumeria* and the American specimens. No less, they are unmistakable. The disk includes eight

staminate fronds, the lowest number thus far seen in cycadeoids; and it is so furrowed on its outer side as to indicate the probable number of the fused petals to be sixteen. The disk diameters are 9 and 19 mm due to compression. Inside the disk the medium-sized synangia are here and there nicely indicated by their outer palisade layer as seen even under a hand lens on smoothed surfaces. This is therefore the second European specimen in which the complete flowers are seen, the third with the preserved synangia. Those I found in *Cycadeoidea etrusca*, though overlooked by Capellini and Solms, were the first, those of *Raumeria* the second recorded.

The foregoing features emphasize the fact that the Mew cycad must rank as the fourth finest European specimen yet discovered, even if it does not stand alone. The record begins with the Dresden *Raumeria*, found or first noted in 1753. This stem bears the large specialized flowers with sixteen stamens like those of the Black Hills, but is held distinct generically because of the wood structure. The second great specimen is the *Cycadeoidea* (Bennettites) *Gibsonianus*, found as noted above about 1850, and twenty years later in the hands of William Carruthers revealing a seed cone organization strangely and unexpectedly different from that of all previously known cycads or other gymnosperms existent or extinct. The third is the *Cycadeoidea etrusca* of the necropolis and nearby Etruscan temple of 4,300 years ago at Marzabotto, and thus the oldest petrifaction of record ever handled by man. Refound in 1878, this stem yielded the first young seed cones with associated pollen grains, indicating the possibility of an amphisporangiate fructification; although Capellini and Solms overlooked the presence of the distinctly chalcedonized synangia, as I found on later examination of the type at Bologna. As the fourth of the European series showing the critical structures, the Mew cycad is therefore the equal of any, in fact the most complete of all in what it shows. As in the great *Cycadeoidea ingens* of the Black Hills, the first event in its fossilization occurred in the springtime. As in the magnolias the flowers appeared early, and then the fronds; although the sparse flowers and cones of this rather young stem seem once more to indicate the presence of monecism in the cycadeoids, rather than the uniformly complete floral type. These features need closer scanning. But as so well recognized the general organization had long departed from the ancient lines, and was specialized in its own way in form and foliage, especially in the increased size and diminished number of the flowers.

The next great find of the Isle of Wight collector, whether in the Greensand or at the "log raft" in the Wealden at Brook (= Como), must be one of those trunks bearing floral buds in all the axillae of the fronds, as seen by Robert Brown. Such, since the assemblage of the splendid series of trunks from the Navajo Country with their full complement of small flowers, must be regarded as the more primitive cycadeoid type.

The aid that has been given from European and other sources in the freest use of priceless and historic specimens of the petrified cycadeoids for comparison in the study of the American material has had a profound meaning and value. It has come in the first instances from Capellini at Bologna, Lignier at Caen, the custodians of the Zwinger Museum at Dresden, and from Britain. It proves that in the foremost countries the collector and the student is free in laboratory and field, and unhampered by legal or other restrictions; while fossil botany is to its devotees a world subject. It shows that eventually some concerted plan must be adopted making the unrivaled American cycadeoid collections a source of material for direct university use and demonstration *per se* of these, the most singular and instructive of all extinct flowering gymnosperms.

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THE NEURO-MUSCULAR MECHANISM CONTROLLING FLASHING IN THE LAMPYRID FIREFLIES

BY the use of a photoelectric cell and amplifier in connection with the string galvanometer,[1] it has been possible to record curves of the flashes of *Photuris Pennsylvanica*. Records of spontaneous flashes and records of electrically stimulated flashes were obtained under normal conditions, under various oxygen tensions, and under various conditions of pressure and other factors. Fig. 1 is an illustration of the curve from a typical normal spontaneous flash.

Analysis of the curves of normal flashes shows that there are two independent mechanisms governing the amount of light in any flash. One is evident through a factor, which, when it varies, affects only the height of the intensity-time curve; it does not affect the ratio of the development and decay portions of the curve, and does not affect the duration of the flash. The other factor affects primarily the duration of the flash; it also affects the height and to some extent the relationships of the development and decay portions of the curve. These findings lend support to the observation, made first by Lund,[2] that either few or many discrete and definite individual areas of a luminous organ may be involved in any flash. The

[1] E. N. Harvey and P. A. Snell, Proc. Amer. Philos. Soc., 69, 303, 1930; *J. Gen. Physiol.*, March, 1931.
[2] E. J. Lund, *J. Exp. Zool.*, 11, 415, 1911.

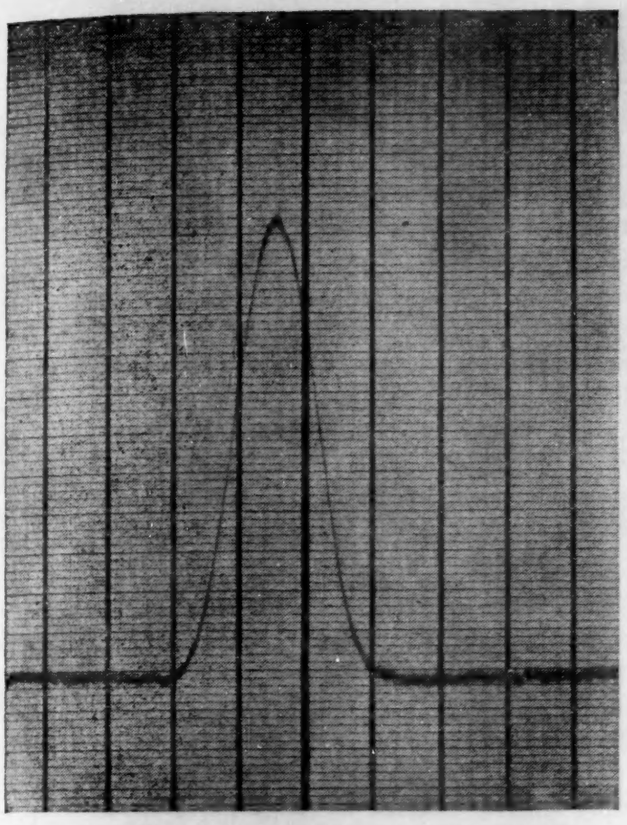

FIG. 1. Normal Spontaneous Flash. Unmounted ♂. Vertical lines indicate .04 second.

factor affecting the height of the curves but not the duration is the expression of the number of units of the luminous organ in action in that flash; the factor affecting primarily the duration is an expression of the activity of the controlling mechanism of these individual areas.

The normal flash shows a large range of intensity due to the two variable factors just described. The duration range is on the contrary comparatively narrow, with very few exceptions lying outside this range which are probably not normal flashes; the duration varies between 0.09 and 0.16 second, with the majority about 0.12 second.

It was found that all the characteristics of a spontaneous flash could be duplicated by the flash of a specimen from which the head and thorax had been dissected, when the abdomen remaining was stimulated in certain ways by singly induced shocks. The strength of current necessary to produce stimulation of all parts of the luminous organ produces injury to the specimen, and these preparations could therefore not be used for experiments requiring a series of observations and records. The analogy of such a preparation with the well-known nerve-muscle preparation is striking. The intensity-duration curve of the flash is similar in nature to the height-duration curve of a muscle contraction.

Reducing the pressure and oxygen tension by vacuum has the same qualitative and quantitative effect on the flash as reducing the tension only by means of oxygen-nitrogen gas mixtures. Normal flashing will take place in oxygen tensions above 20 mm of mercury. Below this point the controlling mechanism is rapidly injured so that it ceases to function, luminescence becomes continuous, and its intensity varies with the oxygen tension. Complete functional recovery takes place if the low oxygen tension is not maintained too long.

These experiments indicate that the mechanism controlling the flashing is responsive to nervous and to direct electrical stimulation, that it effects the control by regulating the admission of oxygen to the cells containing the photogenic substances, and that variation in the character of the flash is brought about by variation either of the number of units stimulated or of the amount of stimulation and response (admission of oxygen to the cells) in the unit involved. The tracheal end cell, which has for a long time been considered by histological investigators to be responsible for the control of luminescence,[3] is certainly the responsive mechanism in this control. Its anatomical features, together with these physiological observations, lead directly to this conclusion.

This work is part of a program of studies on bioluminescence carried out under the direction of Professor E. N. Harvey in the Physiological Laboratory, Princeton, New Jersey.

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SOME OBSERVATIONS ON THE CORTICO-ADRENAL HORMONE

IN a recent short article[1] it was shown that extracts of the adrenal cortex prepared in this laboratory according to the method of Swingle and Pfiffner[2] were remarkably effective in maintaining adrenalectomized cats in apparently normal health and in abolishing the severe symptoms of adrenal insufficiency. Confirmation was given, therefore, of the observations of the Princeton investigators.

To avoid the considerable labor of scraping out the medulla, we have used whole adrenal glands in making our extracts. At the abattoir the glands are exsected from the still warm carcasses and immediately frozen. Shipment is made to the laboratory in carbon dioxide snow, and the glands are finely ground while still in a frozen state and placed in 95 per cent. ethyl alcohol. In the process of preparation of the cortico-adrenal extract, the adrenalin originally present in the whole glands seems to a large extent to disappear. Only traces of adrenalin are left in the crude extract, the

[3] U. Dahlgren, *J. Franklin Inst.*, 1917.

[1] S. W. Britton and Herbert Silvette, SCIENCE, 73: p. 322, March 20, 1931.

[2] W. W. Swingle and J. J. Pfiffner, *Amer. J. Physiol.*, 96: 153, 1931.

rest having been either destroyed by inadvertent oxidation or differentially partitioned between the various organic solvents employed. These traces may be readily removed by a small quantity of permutit—we use 30 grams per 5 kilos of glands—so that the final extract made from the whole glands contains less than 1:2,000,000 parts of adrenalin when tested by the blood pressure or intestinal strip methods. Our extracts are made up to a final concentration of 40 grams of whole glands per cubic centimeter. We have prepared extracts for the past six months according to these modifications of the Swingle-Pfiffner technique, and the product is apparently as potent as any which has yet been reported.

Besides the general restorative effects on comatose adrenalectomized animals, which have previously been described, the cortico-adrenal extract produces significant changes in carbohydrate metabolism. For a period of several hours following injection of the hormone, the percentage of sugar in the blood gradually rises from the convulsive level to normal limits, or even higher. In a series of twenty cases this result has been consistently observed. Normal cats and rats also show slowly rising blood-sugar levels following administration of the extract. In man the material is apparently without effect on the blood sugar in small doses of one or two cubic centimeters; a larger dose—15 cc injected intramuscularly in a subject under basal conditions—produced a gradual rise from 90 to 115 milligrams in 4½ hours.

It should be emphasized that the above glycemic changes are not at all referable to adrenalin action. When injected in similar dilution and amount to that present in the cortical extracts—between 1:2,000,000 and 1:4,000,000 parts of adrenalin, in amounts up to 10 cc per kilo—adrenalin produces only a slight increase in the blood sugar, and a fall to the normal level occurs within an hour or so after the injection. The gradual augmentation of the blood-sugar level following injection of the cortico-adrenal extract, reaching a maximum six or eight hours after the injection, is in marked contrast to the effect of the medullary hormone. Also in contrast to the action of the cortico-adrenal hormone is the merely temporary effect of adrenalin in resuscitating prostrated adrenalectomized animals.

The hypoglycemic and convulsive reactions following insulin administration appear to be scarcely affected, even when large doses of the extract are given intraperitoneally or intracardially. When the material is given as a preliminary measure, an hour or so before the administration of insulin, the action of the latter also appears to be relatively unaffected. In this respect the well-known effect of adrenalin in alleviating the severe symptoms of insulin intoxication finds no parallel in the action of the new cortico-adrenal hormone.

The effect of the cortico-adrenal hormone on carbohydrate metabolism is apparently quantitative in nature. Although different lots of extract differ in potency, and the experimental animals vary in their resistance or susceptibility to the material, experiments performed at various times with a particular extract on the same animal indicate very clearly this quantitative effect. An injection of 10 cc per kilo causes approximately twice the percentage rise in blood sugar, as does one of 5 cc per kilo. In general, it may be said that the blood-sugar raising power of the hormone is a direct function of the amount of the substance injected and also of the elapsed time.

Numerous observers[3] have reported that the percentage of the non-protein nitrogen in the blood becomes remarkably elevated following removal of both adrenals. Hartman *et al.*[4] have recently observed that their cortical extract brings about a reduction in the blood urea of adrenalectomized cats. The high levels of blood non-protein nitrogen which we have observed in a large series of animals are, however, only slightly affected by large doses of the cortico-adrenal extract prepared according to the Swingle-Pfiffner method. The profound anhydremia which is observed in animals following adrenal extirpation, and the extensive circulatory changes which are brought about following injection of the cortico-adrenal extract must, however, be given careful consideration in connection with the observed changes in the carbohydrate and nitrogenous constituents of the blood.

Further blood changes and circulatory effects which we have observed to be produced by the extract, and also the influence of the hormone on body temperature, will be reported upon later.

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[5] Porter fellow in physiology.

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